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SARCOMA OF THE LONG BONES.*

THE DIAGNOSIS, TREATMENT AND PROGNOSIS, WITH A REPORT OF SIXTY-NINE CASES.

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THE subject of sarcoma of the long bones has for many years been a topic of great interest to the surgeon and the pathologist. The classic paper of Gross [1] published in 1879, based upon a study of 165 cases of sarcoma of the long bones, collected from American and foreign reports, was the first comprehensive work upon this subject. Gross's paper was so exhaustive and covered the ground so thoroughly that it was long before any other writer presumed to enter this field. There were, however, certain inherent defects, or rather deficiencies in Gross's paper: first, his cases were all treated before the days of antiseptic surgery and, hence, the mortality from operation was exceedingly high; second, comparatively few cases were traced to final results, thus rendering impossible any accurate idea of the true prognosis of the disease; third, his cases were collected from scattered reports, mostly individual. Inasmuch as successful or particularly interesting cases

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are much more likely to be reported than failures, such a series of cases as Gross's, would be less apt to conform to the actual clinical picture of the disease, especially regarding results, than a total series of cases observed by a single surgeon or treated at a single clinic.

To fill this gap in our knowledge of sarcoma of the long bones, it follows that we must have a series of cases treated since the advent of antiseptic or aseptic surgery, comprising all the cases observed by a single surgeon or at a single clinic during a given period.

Three papers on sarcoma of the long bones published since Gross's, have, in a measure, fulfilled these conditions. The first, that of Nasse,[2] based upon a study of 46 cases observed at von Bergmann's clinic during a period of fifteen years, from 1874 to 1889. The second, that of Reinhardt,[3] who reports 54 cases observed at the Göttingen clinic (König) from 1880 to 1895. The third and most recent paper is that of O. Kocher [4] reporting upon a series of 65 cases observed at the Tübingen clinic (Professor v. Bruns) from 1860 to 1903.

It is true that many of the cases observed at v. Bruns' clinic and some of those reported by Nasse date back to a period prior to antiseptic wound treatment; but Reinhardt's series were all treated since 1880.

Mayer [20] has taken up the statistics of v. Bergmann's clinic in 1889, or the end of the period covered by Nasse, and has endeavored to complete the statistics up to the year 1904. He has tabulated 91 cases, but, unfortunately, he has not separated the sarcomas of the bones from those of the soft parts, and has also included all sarcomas of the extremities, taking in sarcoma of the fingers, the carpus and tarsus. Hence, it is impossible to compare these cases with Nasse's, or indeed with any series of cases of sarcoma of the long bones proper. No less than 51 of the 91 cases collected by Mayer must be excluded as it is not certain that they originated in the long bones.

Nasse states that while Gross's statistics are of interest in some respects, *e.g.*, his figures regarding the relative fre-

quency of periosteal and myelogenous sarcoma, the proportion in which the various bones are affected, the significance of trauma in the etiology of sarcoma, and the many symptoms that are observed in the course of the disease, his material is by no means sufficient to determine the different degrees of malignancy, *i.e.*, to express in figures the differences in final results according to the histological character of the disease or the method of operation employed. Such conclusions are particularly worthless when it comes to the different subdivisions of the rarer types of sarcoma. Besides, his methods of drawing conclusions are so evidently defective in many ways, that it is impossible to obtain from the same any kind of a reliable picture of the results of operation or the malignity of the sarcomas.

With these important and recent contributions to our knowledge of sarcoma of the long bones, it might well seem difficult to find an excuse for another paper upon the same subject.

The two reasons which I offer for the present paper are: *First,* the minor one, that my series of cases of sarcoma of the long bones is the largest yet reported by a single observer; *second,* one of much more importance, I believe, that the results in this series of sixty-nine cases warrant a very radical departure from the present recognized methods of treatment.

In proof of the fact that new methods of treatment of sarcoma of the long bones are urgently to be desired, we need but take a brief survey of the results of present methods.

As I have already stated, too few of Gross's cases were traced to final results to enable us to estimate at all accurately the prognosis of the disease. Passing on to the results at v. Bergmann's clinic (Nasse) we find only 4 of the 46 cases well beyond three years. Of these 2 were myeloid sarcoma of the femur; 1 a periosteal sarcoma of the humerus, and 1 a myeloid sarcoma of the tibia.

The results at König's clinic (Reinhardt), all observed during the antiseptic period, show 7 cases well beyond three

years. Of these 3 were sarcoma of the tibia, 1 of the femur, 2 of the humerus, 1 of the radius.

Of the 65 cases observed at the Tübingen clinic, 9 remained well beyond three years. Of these 3 were sarcoma of the femur, 3 of the tibia, 1 of the radius, 1 of the ulna.

O. Kocher was the first writer after Gross to attempt a compilation from the literature of all cases of cures of sarcoma of the long bones. He collected 48 cases which, with the 9 cures observed at Bruns' clinic, make a total of 57. Of these cases 4 were sarcoma of the radius, 1 of the ulna, 10 of the humerus, 23 of the femur, 12 of the tibia and none of the fibula. In the remaining seven the bone is not indicated.

All statistics show that the prognosis is decidedly worse in periosteal growths than it is in those of central origin.

Of the 57 cases of cures of sarcoma of the long bones, 30 were of the myelogenous type, 15 periosteal; in the remaining 12 the exact character of the growth was undetermined.

The nature of the operation performed in these cases of cure is of great interest: 21 were treated by amputation, 10 by ex-articulation, 17 by resection, 5 by curetting. In 4 cases the nature of the operation is not stated.

No one can help being struck by the large number of cases cured by resection; 17, or nearly one-third of the entire number, were thus cured.

The gloomy prognosis of sarcoma of the long bones, even in face of such radical operations as amputation or ex-articulation at the proximal joint, is still further emphasized by Butlin [5] who, in a series of 68 cases of sub-periosteal sarcoma of the femur collected mostly from English and German clinics, reports only 1 case that remained well beyond three years, and in this case there was some reason to believe that the disease was of central rather than periosteal origin. Of 46 cases of sarcoma of the femur, of the myeloid type, collected by Butlin, 5 remained well beyond 3 years. In the cases of sarcoma of the tibia and fibula, the results were little better. Of 35 cases of the sub-periosteal type, only 1 remained well beyond two years, while of 52 cases of the myeloid type, 9 were well be-

yond three years. Butlin was able to collect only 18 cases of sarcoma of the humerus of the periosteal type, that had recovered from operation. Of these only 1 was known to have been well beyond three years; of 10 of the myelogenous type, 2 were well beyond three years.

Butlin concludes: "We cannot but form the opinion that the disease (periosteal sarcoma of the humerus) is horribly and rapidly fatal and that the prospect of complete cure, or even long immunity from recurrence, is singularly small." Of the sub-periosteal sarcomas of the femur, he states: "The cases which were followed up by Mr. Colby and myself were almost invariably fatal, and in the large majority of them death occurred within a few months of the amputation. In many of the cases amputation was performed within three months of the first observation of the disease; in some of them within a few weeks. From every point of view, I cannot but regard sub-periosteal sarcoma of the femur as a remarkably deadly disease, and I am not yet clear that surgery can do more than palliate the distress occasioned by it, and that only in a comparatively few cases. The only hope of the future is in very early diagnosis and in very high amputation."

Sufficient evidence has been cited to prove that the results of operative treatment of whatever kind, of sarcoma of the long bones in general, are extremely discouraging, while those of the sub-periosteal type, especially of the femur and humerus, are almost hopeless.

My own results of operation for sarcoma of the long bones have been quite as discouraging as those above mentioned. The great majority of my cases were treated by the routine methods now in vogue, namely, high amputation or ex-articulation at the proximal joint; in fact, I have resected in no case. While I have performed amputation at the hip joint eight times without mortality, 4 of the 6 patients in whom it was performed for sarcoma of the femur, died within the year; the fifth in one and one-half years and the sixth was not traced. In 2 in which the amputation was done for sarcoma of the soft parts, 1 died a year later and the other,

who had received several months' treatment with the mixed toxins prior to amputation, now remains well after a period of six years.

While sarcoma of the long bones may occur at almost any age, it is most frequently observed between the ages of twenty and forty. Gross, in 165 cases, found no case under ten years; 45 were between ten and twenty; 55 from twenty to thirty; 26 from thirty to forty; and only 21 between forty and 70.

Reinhardt, in 54 cases observed at the Göttingen clinic, also found no case under the age of ten years. In 35 of the 54 the disease occurred in patients between ten and thirty years; 23 were under the age of twenty.

In 35 cases the tumor had existed less than one year.

The youngest patient of the 65 cases observed at Bruns' clinic was ten years of age; the oldest seventy years; 18 were between ten and twenty; 21 were between twenty and thirty; 7 were between thirty and forty; 15 were between forty and fifty; only 4 were beyond fifty years of age.

My own, as far as I know, is the only series which shows any cases of sarcoma of the long bones under the age of ten years. I have observed 6 such cases, 1 a sarcoma of the humerus in an infant twenty months old, and 4 of the femur in patients aged seventeen months, six, seven and nine years, respectively.

With regard to the relative frequency of the disease in the sexes, statistics vary considerably. Gross's collection shows 149 cases in which the sex was known, 87 were men and 62 women. Of the 65 cases observed at Bruns' clinic 42, 64.6 per cent., were men; 23, 35.4 per cent., were women. Reinhardt's collection of 54 cases observed at the Göttingen clinic gives 40 occurring in men and 14 in women.

My own series shows a much more equal distribution between the sexes: 35 cases in the female, and 34 cases in the male. My oldest patient was aged fifty-six, and youngest twenty months. Six patients were under the age of ten years; 20 from ten to twenty years; 19 from twenty to thirty

years; 11 from thirty to forty years; 5 from forty to fifty years; 7 from fifty to sixty years.

Distribution of Sarcomas Over the Various Long Bones (author's series): Femur, 36; humerus, 13; tibia, 13; fibula, 2; radius, 3; ulna, 2; metatarsal bone, 1; metacarpal bone, 1. Total, 71. 34 periosteal. 22 central. 15 type not stated.

Method of Treatment: Amputation, 20; disarticulation, 16; conservative methods (resection), 6; no operation, 29.

A brief reference to the various methods that have been employed in the treatment of sarcoma of the long bones by the different operators may be of interest:

At Bruns' clinic (65 cases), of 57 cases treated by operative methods, amputation was done in 21, exarticulation in 10, resection in 17, curetting in 5; in 4 cases the method is not stated.

Resection was confined chiefly to the myelogenous type and was performed in only 3 out of the 17 cases of periosteal origin.

Thirty of the 45 cured cases of sarcoma of the long bones collected by O. Kocher were of the myelogenous type, 15 of periosteal origin. It is interesting to note that the method of resection was employed in 16 of these cases.

As to the relative frequency of involvement of the various long bones, Gross's statistics show the femur the seat of the disease in 67 cases: Tibia, 46; humerus, 25; fibula, 13; ulna, 7; radius, 6; ulna and radius together, 1.

Bruns' cases show the femur involved in 23 cases: Tibia in 12; humerus in 10; radius in 4; ulna in 1.

Nasse reports 15 cases of the femur; tibia, 10; humerus, 9; radius, 3; ulna, 1.

McCosh, in his paper[6] reporting the results of 125 cases of sarcoma of all regions, personally observed at the Presbyterian Hospital during the last fifteen years, states that "the majority of surgeons recommend amputation in all cases," and adds that he has never yet seen a case in which he felt that the interest of the patient would have been better served by resection than amputation. McCosh's personal results are, I

believe, the best that have been reported. Five out of 11 patients upon whom he performed amputation for sarcoma of the femur or tibia were well over four years. But, in spite of McCosh's opinion, and the fact that up to comparatively recently my own views and practice have been in accord with his, I am now inclined to believe that resection should be employed in a much larger number of cases of sarcoma of the long bones, particularly of the myeloid type in the radius and tibia, and the results obtained by v. Mikulicz[7] and others, principally German surgeons, seem to justify such a change of attitude. I believe also that the use of the mixed toxins of erysipelas and bacillus prodigiosis after operation will greatly widen the limits within which the operation of resection may be safely employed.

The following cases will, I think, justify this conclusion:

CASE I.—*Sarcoma of the Radius Treated by Resection. Patient Well Six Years Later.*—Mrs. C. H., 26 years of age, first noticed a tumor in the lower end of the right radius in January, 1900. F. H. negative. No history of trauma. The tumor slightly increased in size, and on September 18, 1900, she was operated upon by Dr. R. A. Hibbs of New York. In a letter received from Dr. Hibbs, he states that 2 inches of the radius were removed. Microscopical examination showed the growth to be a giant-celled sarcoma. The space left from the operation gradually filled with granulations and remained open, requiring frequent packing, for nearly two years. In January, 1902, she consulted me for an opinion. At that time the granulation tissue so closely resembled a new growth, that I believed a recurrence had taken place, and advised amputation of the arm. She thereupon consulted Dr. Wm. T. Bull and Dr. Farquhar Curtis, both of whom advised amputation of the arm.

No further treatment of any kind was given except the continued packing of the wound until it finally healed.

I made a careful examination of this patient on November 28, 1906, six years after the operation, and nearly five years after I had previously seen her. There was not the slightest trace of a local or general return. The outer portion of the lower end of the radius has been replaced by new bone. She has perfect

control of the wrist movements and her arm is apparently as strong as before.

This case is certainly a very striking proof of the superiority of resection to amputation in certain myeloid growths of the radius.

The following case shows that with the aid of the toxins resection may be successfully applied even to the more malignant sarcomas of the humerus:

CASE II.—*Giant Round-Celled Osteosarcoma of Humerus.*—A. C., female, 31 years, patient of Dr. John Babst Blake of Boston. In December, 1896, the patient fell, striking the right side; three days later she noticed pain in the left shoulder, especially on motion. This slowly increased and in November, 1897, motion was limited and she was unable to use the arm. At this time the patient noticed a painful lump below the left clavicle. She entered the hospital on the twenty-second day of December, 1897. Physical examination by Dr. Blake at that time showed on the left side, just over the coracoid process, a small, oval, slightly tender and rather elastic swelling; skin movable and normal over it. Movements of shoulder limited, especially in exterior rotation, abduction and extension; limitation apparently due to pain.

December 24, 1897, operation by Dr. Blake: The coracobrachialis and pectoralis minor seemed directly continuous with it. On separating pectoralis major and deltoid, a bluish mass appeared. Dissection being stopped by hæmorrhage, mass was scooped out with the hand. The tumor apparently originated in the coracoid process and had destroyed the end of the humerus, both tuberosities and the entire glenoid cavity. The wound was irrigated with corrosive and four wicks were inserted,—one toward neck of humerus, one to coracoid, one to glenoid cavity and one behind greater tuberosity. Wound healed remarkably well. On January 18, 1898, a course of toxin treatment was begun and continued until July 28, 1898, the patient receiving in all from 20 to 25 injections. Pathological diagnosis proved the growth giant-celled sarcoma. November 27, 1906, or nearly nine years since the operation, Dr. Blake writes that the patient is well and strong, doing all the housework for a family of six; she has extraordinary motion, lacking only a certain amount

in direct extension upward of the hand and arm overhead. She has gained nearly 20 pounds. Dr. Blake showed her before the meeting of the American Medical Association in June, 1906.

Etiology.—It would be neither proper nor profitable to take up the question of etiology in a paper of this kind, but I may be pardoned for briefly stating that I believe sarcoma as well as carcinoma to be of microparasitic or infectious origin. The recent experiments of Drs. Beebe and Ewing with sarcoma in dogs have proved that these tumors can be easily transplanted from one dog to another; that such transplanted sarcomata are true new growths, and not infective granulation tissue, and while as yet there is no positive proof of their parasitic origin, to my own mind this explanation is most in accord with the known clinical facts. Whatever theory we adopt as to the origin of this disease, such theory must take into account the intimate relationship between sarcoma and antecedent injury or trauma.

In a series of 615 cases of sarcoma personally observed, there has been a history of injury in upwards of one-third of the cases. This fact is of too frequent occurrence and has been established by too unimpeachable evidence to be any longer thrust aside as an unimportant coincidence, without etiological significance. In a large number of the cases the tumor developed immediately after and at the exact point of injury in persons hitherto in a state of perfect health. If for the moment we assume sarcoma to be of micro-parasitic origin, it is most easy to explain the part that trauma plays as a causative factor: We know that tuberculosis is not infrequently localized in a given part of the body, a joint or a bone, by reason of a local trauma. Uhlmann (Warren's Surg. Path., p. 195, Osteomyelitis) states that, as a result of a large number of carefully conducted experiments, he was unable to produce the disease (osteomyelitis) by injection of the virus, until some kind of injury had previously been inflicted upon the bone. Therefore, we have reason to believe that the infectious cause of sarcoma, whatever it be, may remain for a long time,

FIG. 1.—Acute traumatic sarcoma of the femur, following fracture (periosteal).

FIG. 2.—Acute traumatic sarcoma of the femur (periosteal).
(Sagittal section.)

or perhaps indefinitely, in the system without harm, until the injury produces such a lowering in the vitality of the parts and their resisting power that the slumbering process becomes active and the neoplasm begins to develop.

In sarcoma of the long bones a history of trauma is even more frequent than in sarcoma of the soft parts. Gross found it in 70 cases in a total of 144 cases; Mayer found it in 31 per cent. of cases; Reinhardt in 16 per cent. of cases; Nasse in 15 per cent. of cases; Kocher in 20 out of 65; Ziegler in 67 out of 171. My own cases show accidental injury in 31 cases out of 66 in which the presence or absence of trauma was noted, or 47 per cent. In 3 cases the sarcoma developed at site of a fracture.

Diagnosis of Sarcoma of the Long Bones.—Given a tumor of the long bones, the most important step towards making a correct diagnosis is to get a careful clinical history of the case. Points of special importance:

(1) The age of the patient.

(2) Presence or absence of a history of local injury.

(3) Hereditary influence, remembering that sarcoma not infrequently occurs in persons whose ancestors died of carcinoma.

(4) General health of the patient may aid in differentiating sarcoma from tubercular disease, patients suffering from sarcoma, especially in the early stages, being usually persons in the most robust health.

(5) Location of the swelling as regards proximity to a joint.

(6) Presence or absence of pain.

(7) Duration of the growth.

(8) Periosteal or central origin of the tumor.

(8a) Consistence of the tumors (presence or absence of fluctuation).

(9) X-ray examination.

(10) Examination of the blood.

(11) Microscopical examination of a section removed either with a tumor punch, or by exploratory operation.

The condition that most closely resembles sarcoma of the bone is tuberculosis of the bone; its similarity is often so great that the most expert diagnosticians have failed to differentiate the two conditions. In some cases it may be quite impossible to make a diagnosis without the aid of a microscopical examination of a specimen removed, but inasmuch as there are certain risks connected with these exploratory incisions, it is most important to be able to make a diagnosis, if possible, without such aid. In the great majority of cases of sarcoma of the long bones, the following clinical picture will be found to be sufficiently accurate to enable one to render a correct diagnosis: The patient will almost always be between 10 and 50 years of age, the majority between 20 and 40; general health will be perfect; there will be no family history of tuberculosis and no evidence of previous tubercular lesions. There will be a history of local injury of some sort in one-third to one-half of the cases—a blow, a fall, fracture, a severe sprain—at some longer or shorter interval, usually less than six months, prior to the first appearance of the tumor. The first symptom the patient will have noticed will be local pain or local swelling, in about equal proportion of the cases. Gross states that pain occurs as first symptom in 62 per cent. of the cases, a tumor in 33 per cent. In many of my own cases pain has been absent as an early sign, and not of great severity until the later stages of the disease. The cases in which pain has been an early symptom have usually been treated for rheumatism for a longer or shorter time. In upwards of two-thirds of the cases of sarcoma of the long bones the tumor will be found located in one end of the bone, the lower end in the femur, the upper in the tibia and humerus, probably starting in the epiphysis, but very rarely invading the joint except in the later stages of the disease. In a few cases, especially those of the femur and tibia, it begins in the middle of the bone, and here it is nearly always the periosteal type, forming a fusiform enlargement of the shaft in the early stages when the diagnosis is important and treatment of value. The duration of the tumor or rapidity of its growth is also an important diagnostic sign.

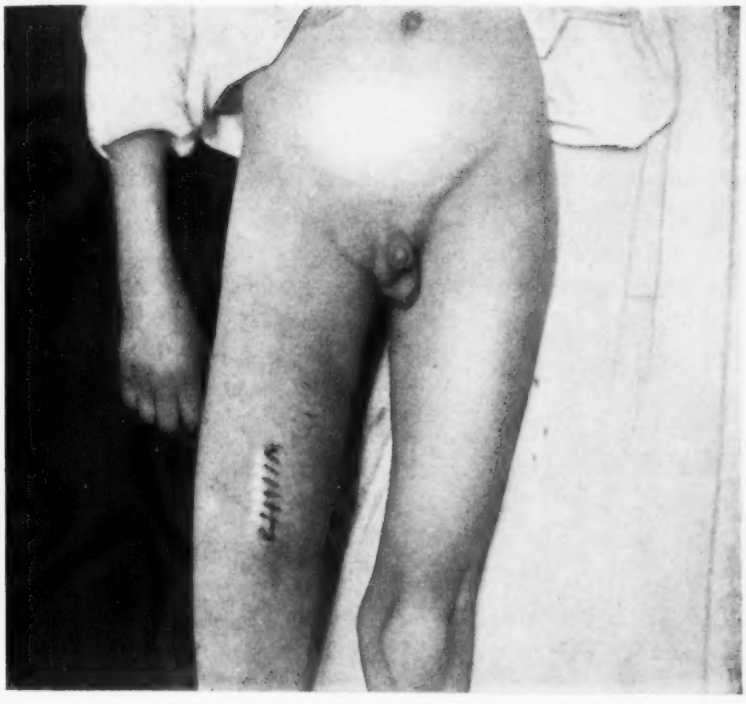

FIG. 2a.—Sarcoma of the femur. Acute traumatic malignancy. Photograph taken three weeks after a kick.

In nearly all cases the rate of growth is much more rapid than in either tuberculous or syphilitic swellings. In tuberculosis the joint is early invaded; there is more limitation of motion in the joint and more atrophy of the muscles of the limb above. Seen in the later stages when the whole joint is affected by the disease and the patient has become emaciated and exhausted, the similarity of sarcoma to tuberculosis is very great.

The consistence of the tumor in sarcoma varies greatly with the type of tumor. In growths of periosteal origin, in the early stages, the consistence may be very firm; later on, when the tumor has reached considerable size, especially in the round-celled variety, the consistence may be very soft and semi-fluctuating, the tumor itself being soft and mush-like in appearance. In other cases of periosteal sarcoma, while the consistence of the tumor in general may be quite firm, there may be areas of marked softening and, in some instances, fluctuation due to the liquefaction of bone or cartilage. The introduction of a sterile needle with the withdrawal of clear serum will enable us to differentiate the condition from tuberculous abscess. In still other cases, particularly the myelogenous sarcomas of the upper end of the tibia, the tumor may show areas of softening similar to those described and other areas which, on palpation, give the egg-shell crackling sensation which is fairly characteristic of the disease.

The temperature may offer some slight help in the diagnosis. A regular evening rise of temperature of 1 to 2° would be slightly in favor of tuberculosis, although it is not at all infrequent to find slight, irregular temperatures in sarcoma of the femur even in the early stages.

I have on several occasions observed a temperature of 99½° to 100° or 101° in sarcoma of the femur, and in some cases of sarcoma of bony origin I have seen a temperature of 103°.

In the very rapidly growing sarcomas of the bone, the tendency to rise of temperature is more marked. Involvement or non-involvement of the joint is of the utmost importance in

differentiating the two conditions. As stated before, in sarcoma the joint is very rarely involved, never in the early stages except in the exceedingly rare cases where the sarcoma begins in the synovial membrane (Rydygier).

v. Ruediger Rydygier, Jr., in his recent "Contributions to the Diagnosis and Therapy of Primary Sarcoma of the Knee-Joint Capsule," states that while sarcoma of the region of the knee joint is by no means rare, he has been able to find only 9 cases of primary sarcoma of the synovial membrane, to which he adds one case observed at Rydygier's (his father's) clinic. He has found all authors to lay special stress upon the great diagnostic difficulties of this trouble, and claims that the case observed at Rydygier's clinic is the first one in which the diagnosis of sarcoma was made before operation. The disease in this case had existed for two years prior to operation, showing the unusually slow course of sarcoma in this locality. Resection was done and the patient remained free from any signs of recurrence when last seen, a year after operation.

Rydygier points out the following characteristic symptoms of sarcoma of the synovial membrane:

In spite of the considerable swelling of the knee-joint region, motion is usually very little impaired, which he thinks is due to the fact that the periosteal covering of the joint surfaces and bone in most cases remain intact, the disease having no tendency to invade the neighboring parts. For this reason, too, there is absence of crackling or crepitus on motion, a sign generally seen in advanced stages of tuberculosis. There is little or no interference with walking, so that atrophy of the muscles is rarely pronounced. Pain, as a rule, is absent or insignificant. Puncture invariably showed sero-sanguinolent fluid or blood, but never pus. The inguinal glands were not involved in any of the cases observed, and with exception of one case, there was no rise of temperature in any of the reported cases.

Examination of the blood shows nothing at all characteristic. There is apt to be a slight leukocytosis, which may reach from 15,000 to 20,000, and occasionally there is an increase in lymphocytes, also an increase in the eosinophiles.

The contour of the tumor is of considerable importance. In tuberculosis starting in the epiphysis and soon involving the joint, the clinical picture is very different. There is swelling of the whole joint, more or less symmetrical, while in sarcoma, especially of the femur, the swelling is apt to be unilateral or more or less irregular, and does not extend into the joint, but

further up the shaft of the femur than is seen in tuberculosis. Not infrequently there are areas of softening or fluctuation in sarcoma, which can be made out on deep palpation and are due to the formation of a cyst by liquefaction of bone or cartilage, but this fluctuation never communicates with the joint, a fact which enables us to differentiate the trouble from tuberculosis. The color of the skin may be of significance; it is less pale than found in tuberculosis, and at times distended veins give it a bluish color.

While it is always wise, if possible, to have an X-ray photograph made of the tumor, in the great majority of the cases nothing characteristic will be found, except perhaps in the later stages when the diagnosis is easy without the X-ray. In the early stages—I agree with Butlin—that it is not only of little help, but in certain cases entirely misleading. The X-ray may be important in showing periosteal or central origin of the tumor, but I do not agree with Kramer [12] in regarding it as a valuable aid to diagnosis in the early stages.

The differential diagnosis between sarcoma and syphilitic lesions is not nearly so difficult. There will usually be found evidence of syphilitic trouble elsewhere in the body, even if no history of primary disease can be elicited. In addition to this, the fact of the much slower growth, the location of the tumor in the shaft of the bone rather than the extremity, will be sufficient to establish the diagnosis. There is one other condition, to which I have not seen attention previously called, but which in a case personally observed was mistaken for sarcoma by surgeons of great experience, and that is osteo-arthritis. In this case the X-ray was of decided help, as it showed a much larger amount of new bone formation and this formation much more irregular in character than is often seen in sarcoma. In addition the marked, almost complete ankylosis of the joint was most significant. Finally, further examination showing typical osteo-arthritic enlargement of every joint in both hands, made the diagnosis of osteo-arthritis of the knee certain.

In some cases, and perhaps in a considerable number, it

may be important to establish the diagnosis before the clinical signs are sufficiently marked to render this possible with any degree of certainty. In these cases we may remove a portion of the tumor either by means of a tumor punch, or, better, a simple exploratory incision. I believe that certain risks are attached to these preliminary explorations, due to the possibility of infected cells getting into the circulation, thus setting up metastases in other portions of the body. The advantages, however, to be gained by such positive knowledge of the nature of the growth, enabling the surgeon to apply immediate treatment, whether it be amputation or injections with the mixed toxins, far outweigh the dangers from exploratory incision. If the patient is put upon the toxins within a few days thereafter, I believe that whatever cells may have been carried through the circulation will by that time still be in a state of such unstable equilibrium, that they will probably be destroyed by the toxins. As a matter of fact, the early appearance of metastases after amputation in cases in which no preliminary exploration was made, has proved that the infected cells enter the circulation early in the disease.

I do believe it is impossible, in many cases, to make a differential diagnosis between sarcoma and cyst of the long bones, without a careful microscopical examination. In a few cases one may be able to differentiate the two conditions from the following points:

(1) Cyst of the long bones is very rare, D'Arcis, in 1906, having been able to collect from the literature but 31 cases.

(2) Nearly one-half of the total number of cases have been found in the upper end of the femur, a relatively infrequent seat for sarcoma. Six occurred in the upper end of the tibia, six in the upper end of the humerus.

(3) Another important point is that cysts of the long bones are, as a rule, of much longer duration than sarcoma. A history of trauma and spontaneous fracture are found with almost equal frequency in sarcoma and cyst. To show the difficulty in making the diagnosis, I would cite the following case:

FIG. 3.—Sarcoma of the femur and ilium (Coley). Two months' duration, in infant aged one year and nine months.

FIG. 4.—Sarcoma of the femur (myeloid).

FIG. 5.—Periosteal sarcoma of the femur. Hip joint amputated.

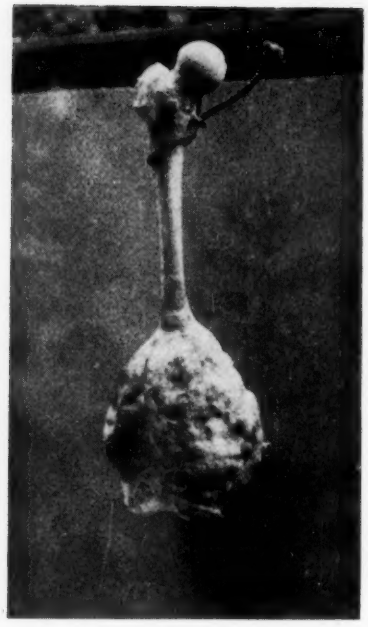

FIG. 6.—Periosteal sarcoma of the femur. Specimen removed from patient shown in Fig 5.

CASE III.—J. S., aged twenty years, F. H. negative. The patient was referred to me by Dr. Townsend of the Hospital for Ruptured and Crippled, and admitted to the General Memorial Hospital March 7, 1906, with a history of having sprained his right ankle four years ago. A slight swelling appeared which never entirely disappeared. In July, 1905, he began to have pain on standing on the right leg. This pain and disability gradually increased up to the present time, and he has been unable to work since December, 1905. An exploratory incision was made by my associate, Dr. Downes, and on cutting through a very thin layer of bone just above the malleolus on the inner side, a large cavity was opened, extending 4 to 5 inches upwards. The same was filled with clear serum and of the lower end of the tibia there remained only a thin shell. Macroscopically, there was nothing that resembled tumor tissue; the case seemed to be one of those rare cases of cyst of the long bone. A piece of the bone removed with a chisel, however, was decalcified and microscopical examination proved it to be a round-celled sarcoma.

The toxins were given four to five times a week in large doses from March 7 to July 6, 1906. The patient was able to get about more easily. The leg decreased 1 inch in size. His later history I have not been able to trace.

I feel sure that had not great care been taken in removing a piece of the bony shell and having it thoroughly decalcified, the case would have been reported as a cyst of the long bone.

This case helps to confirm the opinion of certain authorities who believe that practically all cysts in the long bones are really sarcomas.

For further aids in diagnosis the reader is referred to the recent papers of Kummer,[24] Lexer,[22] and Bokenheimer.[23]

Reinhardt states that in spite of most careful consideration of all diagnostic points it is impossible in a certain proportion of cases to render a positive diagnosis without puncture or exploratory incision. In all cases of sarcoma of the bone observed at the Göttingen Clinic between 1880 and 1895, in which there was the slightest doubt as to the diagnosis, the tumor was incised or, if necessary, a piece of bone removed. In 54 cases exploratory incision was considered necessary in 34. Two of these were punctured; 29 incised. In one instance enlarged inguinal

glands were removed prior to the main operation, and the diagnosis rendered on basis of examination of these. In two cases the diagnosis of tuberculosis disease of the joint had been definitely made and resection was begun, when it was seen that the trouble was sarcoma. According to Reinhardt the most frequent difficulty has been to render the differential diagnosis between tuberculosis of the joint or joint-end and sarcoma in the region of the epiphyses. In many cases effusion into the joint adds to the difficulty. He cites a case showing that even after exploratory incision doubt may exist as to whether the disease is sarcoma or tuberculosis.

Sarcoma of the Femur.—More than half of my entire series of sarcomas of the long bones occurred in the femur, namely 36 out of 69.

The ages of the patients range between one and a half and fifty-eight years.

As regards the sexes, 17 patients were females and 19 males.

Amputation at the hip joint was performed in 13 cases; high amputation in 10 cases. In 13 cases no operation was performed, the patients being either too far gone for any operation, or refusing operation, as was the case in two or three instances.

In 4 cases the mixed toxins were used after operation as a prophylactic against further recurrence. Twice they were used in cases of sarcoma of the upper end of the femur, too extensive even for hip-joint amputation. One of these cases was treated at the Montefiore Home for Incurables. The tumor had been pronounced inoperable by Dr. Gerster, of Mt. Sinai Hospital. A specimen removed was pronounced round giant-celled sarcoma both by Dr. Mandlebaum, pathologist to the Mt. Sinai Hospital, and Dr. T. M. Prudden, Professor of Pathology to the College of Physicians and Surgeons, Columbia University. The disease was advanced so far as to produce spontaneous fracture. The patient finally recovered under the mixed toxins and has remained well since more than four years.

In a second case, personally treated by me, the result was even more remarkable, since here we had to deal with a subperiosteal sarcoma of the small round-celled type, involving

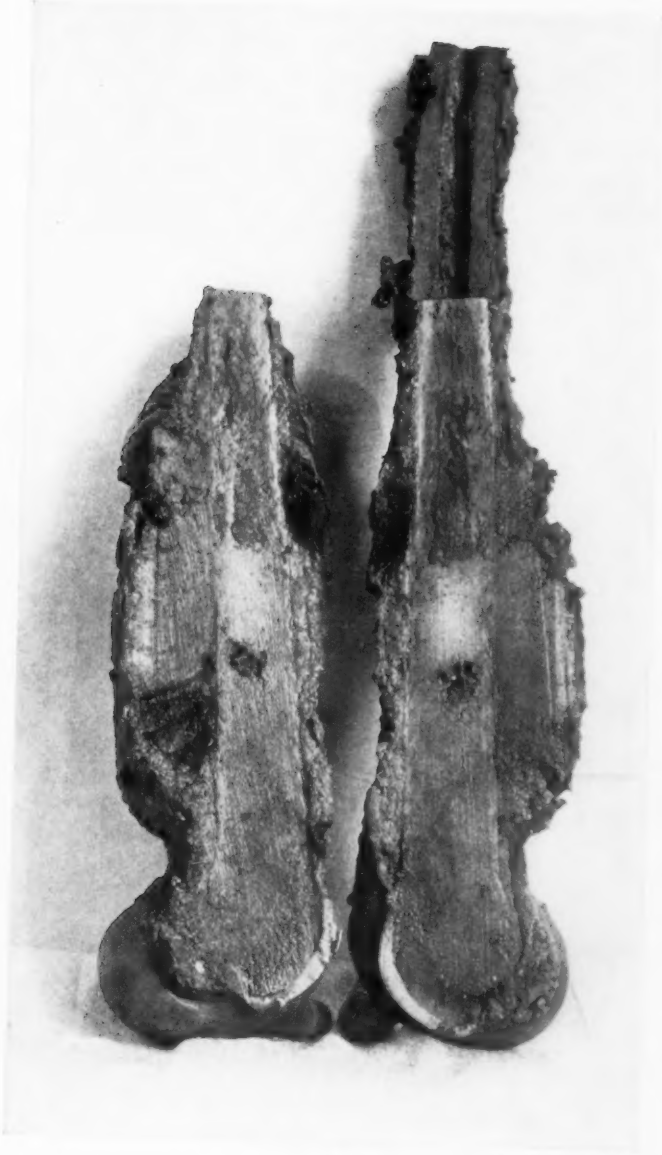

FIG. 7.—Round-celled sarcoma of the femur (periosteal). (Bull.)

the lower two-thirds of the femur. In addition there were extensive metastases in the pectoral region and the iliolumbar region. The patient had absolutely refused amputation. Metastases had occurred while he was taking the X-ray treatment in 1902. Finally, under the mixed toxins, he recovered fully. I presented him before the New York Surgical Society in November, 1906, four years later.

In two other cases the toxins were used before resorting to amputation. One, a case of myeloid sarcoma of the lower end of the femur, in a girl of 16 years, on whom the treatment was begun in April, 1906. The first two to three weeks there was marked improvement; later the tumor again began to increase in size, and at the end of five weeks amputation was done below the trochanter. After the patient recovered from the operation, she was put upon the mixed toxins again and the treatment was kept up for five months at the Hospital for Ruptured and Crippled. She has gained 38 pounds and is in perfect health at the present time, eight months later.

A second case, in which I have used the toxins before amputation in sarcoma of the femur, is that of a boy of ten, with a fusiform round-celled sarcoma starting in the middle of the left femur and involving six inches of the shaft. The toxins were begun on the last of November and have been continued up to the present time, February 16, 1907. The tumor at once showed a decrease in size. The pain, which was severe, disappeared after the first two injections. At the end of two weeks there was a decrease in size of one inch. December 25, the doses were reduced from 11 minims to 2 to 3, and an increase was again noted. The patient is still under treatment and the doses have again been increased with the hope of avoiding amputation. January 4, 1907, the tumor is smaller than at any time since treatment was begun, the circumference of the thigh having decreased from 11¾ to 9 15-16. February 16, 1907, the patient is steadily gaining weight and there is a reasonable hope of saving the limb.

In five cases the toxins were used after amputation in sarcoma of the femur, without waiting for a recurrence. In

one of these cases, a periosteal sarcoma of the middle of the femur, the patient lived two years, dying of local and general recurrence. The other four patients are still alive, but too short a time has elapsed to warrant their being called cures. One is well eight months, 1 seven months, 1 six months, and 1 five months.

The results in the 12 cases treated by hip-joint amputation were as follows:

Of the 6 cases operated on by myself, all recovered from the operation, but the 5 that were traced all had local or general recurrence within a few months, and 4 died within eight months and the fifth within a year and a half. One patient was lost sight of after three months. Of the remaining 5 in which the operation was done by other surgeons, but which came under my care before or after operation, the results were as follows:

One, a girl aged thirteen years, operated upon by Dr. Rushmore, remained well when last seen, five years after operation. Of the other 4, 3 died within a year, and the fourth was not traced.

In short, of the 13 cases treated by hip-joint amputation, only 1 was cured, and, without exception, the deaths all occurred within a year after amputation. There seemed to be little difference in the malignancy, whether the tumor was periosteal or myeloid.

Of the cases treated by high amputation below the trochanter, 10 in number, 1 died two years later. (He received toxin treatment for several months after amputation.) One died four months later of metastases in the lungs; a third died seven months after operation of metastases; a fourth died six months after operation. The other cases were treated with the mixed toxins immediately after amputation below the trochanter, and remain well at the present time, five, six, seven and eight months after operation. Two patients have gained between 26 and 38 pounds each and none shows any signs of recurrence. The toxins were given for five months in 2 cases and 2 others are still under treatment.

FIG. 8.—Sarcoma of the humerus (Coley). Two month's duration. Case IV.

Sarcoma of the Humerus.—Sarcoma of the humerus is very rare and exceedingly malignant. The upper end of the bone is most frequently involved, but the whole shaft is quickly invaded; the surrounding tissues are infiltrated. In a case which was personally observed and in which I performed amputation at the shoulder joint, half the clavicle was involved and most of the scapula. The disease quickly recurred in the portion of the clavicle remaining, with metastases in the spine. In sarcoma of the humerus, there seems to be a special proneness to recur in the opposite humerus; this has been noted in 2 cases personally observed.

While diagnosis ought to be possible in the early stages, a study of the reported cases will show that early diagnosis is seldom made. In 2 cases the patients were treated for rheumatism until the tumors were about the size of a cocoanut. The rapidity of the growth was undoubtedly enhanced in the one case by the electric vibrator treatment and, in the other, by vigorous application of osteopathy. In neither case had there been any history of previous rheumatism.

The sudden discovery of a hard, painless swelling in the humerus, especially in its upper portion, with or without previous injury, in an apparently perfectly healthy individual, should arouse strong suspicion of the presence of sarcoma. Almost the only condition likely to be mistaken for it would be a chondroma, which is much rarer and of very much slower growth.

The following case shows well the extremely rapid course of this disease:

Case IV.—*Sarcoma of the Humerus.*—I. S., 19 years, born in Germany, admitted to the General Memorial Hospital May 21, 1906; died July 5, 1906; no treatment employed. F. H. negative. On admission the patient gave the following history: No trauma. Pain in the right shoulder for three months; swelling was noticed at about the same time, in January, 1906. The swelling increased very rapidly. The patient first entered Mt. Sinai Hospital on April 10 and amputation at the shoulder joint was advised by Dr. Gerster. The patient left the hospital, and

when re-admitted a month later, the tumor had increased so markedly, that operation was entirely out of question, and the man was referred to me by Dr. Gerster. Examination at this time shows the right humerus the size of an adult head, measuring 10⅞ inches at the elbow, just below the tumor; the tumor itself showed a circumference of 25 inches. The patient's general condition was extremely bad, he was greatly emaciated; weight 95½ pounds. The tumor had grown to such dimensions that the arm, in a recumbent position, instead of lying against the side, was pushed 4 inches outward. Shortly after his admission to the hospital, spontaneous fracture occurred. Sharp spicules of bone punctured the skin at the lower extremity of the humerus; 12 pounds of bloody serum exuded during the next 24 hours; several quarts continued to exude daily until the time of death, July 6. His condition on entrance was such that no toxin treatment was deemed advisable.

This is one of the most rapidly progressing cases that I have ever seen, the total duration of life being about 5 months from the time of the first appearance of pain to death.

The growth in sarcoma of the humerus is so rapid that one can see its increase in size from day to day. In the cases that I have observed, 13 in number, pain has been a fairly early sign, but has not been severe until the tumor has reached considerable size. The tumor originated in the upper end of the bone in all cases except 1, in which it started in the middle. The pain was never marked except in the later stages of the disease. Sarcoma of the humerus shows a greater tendency to infiltrate the neighboring tissues, both bone and soft parts, than sarcoma in any other locality. The axillary glands are not infrequently involved, and the scapula and clavicle are early invaded by the disease. The almost hopeless prognosis in these cases is shown by the collections of Barling [10] and Dent.[11]

Of the 13 patients in my series, 5 were females, 8 males, and their ages ranged between twenty months and fifty-eight years; 5 were under twenty years of age and only 3 over thirty years. Antecedent injury was noted in 4 of the 13 cases.

FIG. 9.—Case IV. Sarcoma of the humerus, four months' duration (Coley).

In 10 of the cases the tumor had been observed less than six months; in 3 cases from one to three months.

Methods of Treatment.—In 4 cases amputation was refused, though strongly urged. Amputation at the shoulder joint was performed in 6 cases, with 1 death from shock. (In this case the tumor was very large. I saw the patient in consultation and advised operation, but it was performed by another surgeon.) Resection was performed in 3 cases.

In the 6 cases in which shoulder-joint amputation was done, 1 died of the operation and the remaining 5 all died within four to ten months. Of the 3 in which excision was performed 2 were lost sight of. The third is the case of Dr. Blake, of Boston, which I have already reported at length in the present paper. The head of the bone was excised, but it was thought certain that some of the tumor was left behind and the patient was immediately put upon the toxins; she is now well, more than nine years after.

In 3 cases the mixed toxins were used after operation, twice after amputation, once after excision. The 2 cases in which the toxins were used after amputation were treated by myself, and in both cases the toxins failed to check the return of the disease or to prevent a fatal issue. Yet, the fact that the only cure in the entire series of 13 cases (Blake's) was undoubtedly due to the toxins, is sufficient to justify the use of the toxins after operation. In only 1 case did I use the toxins before operation with the hope of saving the arm. In this case a very rapidly growing sarcoma of the humerus in a girl of thirteen, the tumor decreased in size during the first ten days, but soon began to increase again until, at the end of three weeks, I urged amputation; but the family would not consent and took the patient from the hospital.

The most complete data as regards the end results of operations for sarcoma of the humerus are found in the exhaustive paper of Jeanbrau and Riche (*Rev. de Chir.*, 1905, No. 8). These authors have collected 125 cases in which the interscapulo-thoracic amputation has been performed for tumors of the humerus, clavicle and scapula.

Sixty-four of these amputations were performed for malignant tumors of the humerus, with only 2 deaths. Fifteen, or 23 per cent. of these patients, were well from three to sixteen years.

Two of the cases, although classed as sarcomas, must be excluded, as 1 (Berger, seven years) was a myxoma and the other (Berger, sixteen years) an enchondroma. One died seven years after the first operation of generalization after three operations had been performed for local recurrence.

While these statistics show 20 per cent. of cases well beyond the three-year period, they can by no means be taken as an accurate index of the curability of sarcoma of the humerus treated by amputation. They have been collected from the medical literature of all countries, mostly from individual reports and, doubtless, the complete or partial success of the operation has had much to do with the publication of many of the cases. There have probably been many cases of failure which have not been reported.

Sarcoma of the Tibia.—With exception of the femur, the tibia is more frequently affected than any other of the long bones; the fibula much more rarely. The upper end of the tibia is the common site of origin. The disease is more often of central origin and of the giant-celled type. It is much less malignant than sarcoma of the femur and runs a slower course. Here, as in the femur, the joint is not affected in the early stages; and in cases of central origin, when all but a thin outer shell of the bone has been destroyed by the advancing growth, the characteristic egg-shell-crackling sensation may be elicited on pressure.

I have observed 13 cases of sarcoma of the tibia and 2 of the fibula. The ages of the patients ranged between seven and fifty-four years; 6 were under twenty years; 9 of the 15 under thirty years of age. The age of the fibula patients was fifty-four years in each instance. Nine of the cases were females and 6 males.

The location of the tumor in my series was more variable than is usually seen according to other writers. In 6 cases it

was in the middle, in 3 at the lower end, in 4 at the upper end.

Methods of Treatment.—Amputation above the knee was performed in 6 cases, without mortality. Amputation was advised, but refused by the patient, in 6 cases. Excision was performed in 1 case, and the mixed toxins were used before amputation in 2 cases.

Results.—Of the 6 cases in which amputation above the knee was done, 1, operated upon by myself ten years ago, still remains well; 1, operated upon by Dr. McBurney in January, 1894, died seven months later of metastases; 1 developed pleural and general metastases in four months, with death in six months; 1 was not traced; 1 had pleural and lung metastases five and a half years after amputation (Bull) with death six months later; 1 (fibula) lived two years and then died of lung metastases. In short, of the 6 cases amputated above the knee, only one was permanently cured.

Of the remaining cases, 1 in which excision was twice done for sarcoma of the lower end of the tibia with immediate recurrence after both operations, was then treated with the mixed toxins of erysipelas and bacillus prodigiosus. The X-ray was also used in conjunction with the toxins and the treatment kept up for nearly six months. The tumor disappeared and the patient is still well, nearly two years later.

In another case of sarcoma of the middle third of the tibia, recurrent after operation, I decided to use the mixed toxins before sacrificing the limb. The toxins were begun in February 1899, and continued for two to three months, with the result that the tumor entirely disappeared, and the patient is still in good health, working upon his farm in Chesley, Ontario.

The other cases in which operation was refused have not been traced. In 1 other case, a sarcoma of the fibula, the toxins were used before amputation without controlling the disease, and then amputation was performed. The patient died two years later of lung metastases.

Sarcoma of the Radius and the Ulna. Five cases: three of the Radius, and two of the Ulna.—Sarcoma of the ulna is so extremely rare that the following cases are given in detail.

Butlin states that not a single case of sarcoma of the ulna has been observed at St. Thomas' Hospital in fifteen years:

CASE V.—*Sarcoma of Ulna.*—D. J. S., 25 years. F. H. good. On December 8, 1898, Dr. George Tully Vaughan amputated the right arm in the lower third for sarcoma of the ulna. The patient at that time gave a history of having had a "greenstick" fracture of the right ulna three years before, from which he recovered. Two and a half years later, the bone began to enlarge at the site of the fracture, and about three months later, the bone broke at this point as a result of throwing a stone or cob. Examination at that time (three years after the "greenstick" fracture), showed a spindle-shaped enlargement of the middle of the right forearm, the circumference being 1½ inch larger than the left. The surface temperature was distinctly higher than on the left forearm. The swelling was firm, semi-fluctuating, not tender, except at a point on the border of the ulna where motion and crepitus were felt. A skiagram showed a fracture of the ulna in the middle third and a mass springing from the upper border of the ulna and extending towards the radius. Subsequent exploratory incision showed this mass to be soft, like granulation tissue, attached entirely to the interosseous border and mainly to the upper fragment. A piece was removed for microscopical examination which was made by Drs. Kingdon and Sprague, who pronounced it round-celled sarcoma with a few spindle cells. The patient made a good recovery and remained well until February, 1906, when he noticed an increase in the size of his abdomen, but as he had no pain or discomfort from this swelling, he pain no attention to it. In the beginning of October, he began to have pain and consulted Dr. J. W. Perkins of Kansas City, Mo., who referred him to me. Physical examination made by me on October 29, showed the patient to be well nourished, having apparently not lost any weight, although he looked slightly anæmic. Right arm was absent; there was no local recurrence nor were there any signs of a return of the disease in the axilla. Examination of the abdomen showed the same markedly protuberant, but symmetrically enlarged. Palpation showed the abdomen filled with an enormous tumor, extending from the ensiform cartilage nearly to the symphysis pubis. The intestines are pushed over to the left side. Several large masses, each the

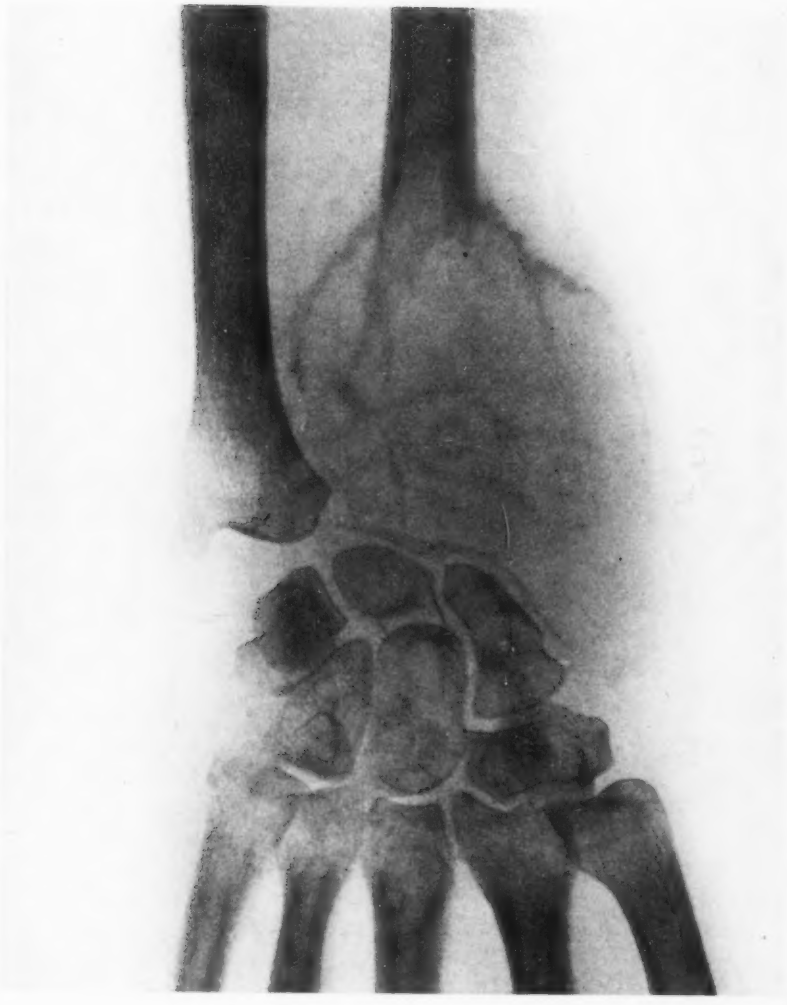

FIG. 10.—Sarcoma of the radius.

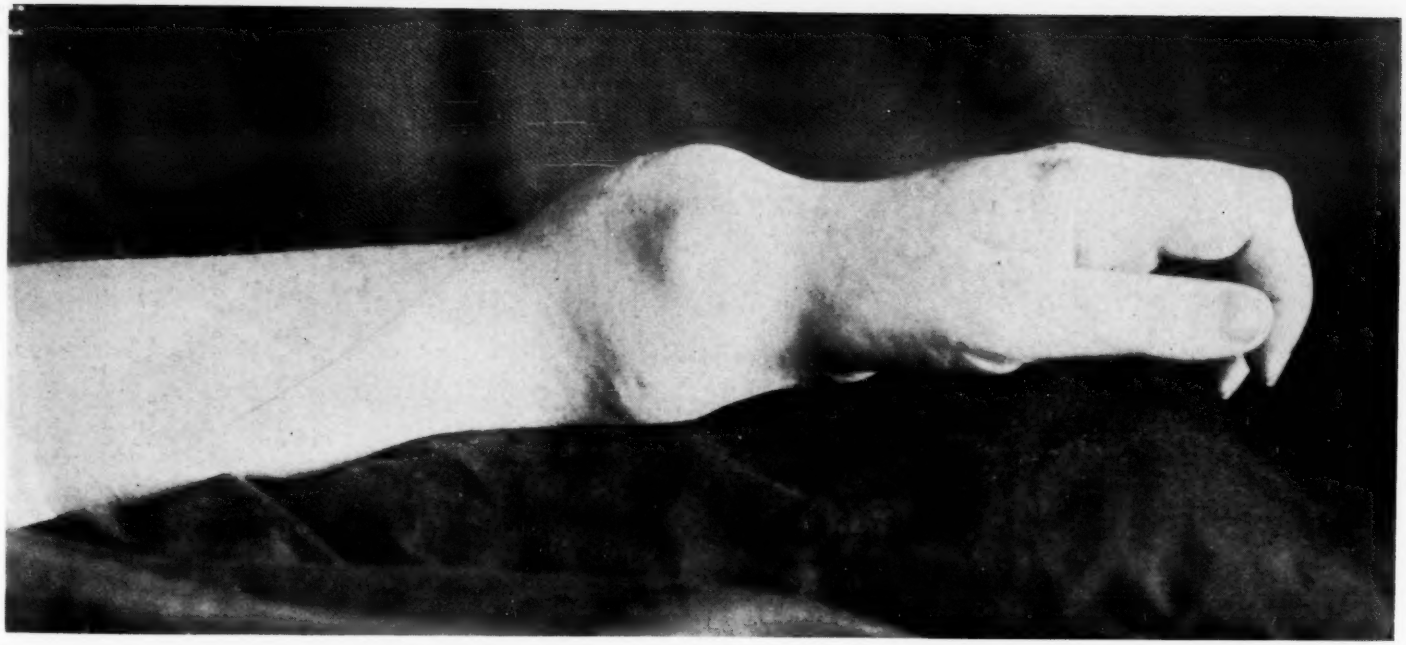

FIG. 11.—Sarcoma of the radius (Coley). Amputation, and mixed toxins after operation.

size of a child's head, more or less independent from one another, can be made out. They seem to start in the retroperitoneal glands, and be pushing forward. There was no ascites.

The patient was put upon the mixed toxins in November, 1906, with little hope of doing him much good, but at the end of one month's treatment the masses in the abdomen had decreased in size so much that the circumference at the umbilicus was 5 inches less than when the toxins were begun. He is still under treatment.

February 8, 1907.—The tumors are less than one-third the size at the beginning of treatment three months ago. He is steadily gaining in health.

The second case I owe to the courtesy of Dr. P. W. Nathan, who has given me the privilege of publishing it. I had arranged to see the patient in consultation, but death occurred in the interval.

CASE VI.—*Sarcoma of Ulna.*—H. F., 24 years, married; one child; never sick since child was born. In December, 1905, while scrubbing, she knocked the inner side of the right arm against the pail. The arm felt sore for a few days, then was apparently well. About a month later she began to have pain in the arm at the site of the injury and noticed a slight swelling. Both swelling and pain increased. The pain became constant and often kept her awake at night. She soon became emaciated and was slightly cachectic in March, 1906, when Dr. P. W. Nathan saw her. The swelling in the lower end of the right ulna was about the size of a small peach, apparently involving the whole circumference of the ulna. The tumor was hard and smooth and the soft parts were fully movable over it. Wrist and elbow joints apparently normal; tumor not particularly painful on pressure. Amputation was advised, but declined. When seen again by Dr. Nathan, in November, 1906, the tumor was about the size of a small baby's head, extending almost to the wrist at one end and the middle of the shaft at the other; the glands in the axillary and cervical regions were markedly enlarged. There was also a small tumor in the lower end of the sternum and she complained of pain in the back. The spine was stiff in the lower dorsal region. She had œdema of the lungs; heart sounds were very

weak and the patient was extremely emaciated. She died the following day. These two cases show the strong tendency to metastases in sarcoma of the ulna.

Sarcoma of the Metacarpal and Metatarsal Bones.—Sarcoma of the metacarpal or metatarsal bones is very rare, and the former even rarer than the latter. In my list of 615 cases only 3 cases of sarcoma of the metacarpal bone have been observed, and in only 1 of these was the disease primary in the metacarpal bone. This case was one of acute traumatic malignancy, the tumor appearing in a perfect healthy, robust young lady, immediately after a blow upon the back of the hand. It was treated at first as acute periostitis, later, as probable tubercular osteitis. At the end of four months, at which time there was marked thickening of the periosteum as well as metacarpal bone itself, a specimen was removed and microscopical examination proved it to be an alveolar round-celled sarcoma. Immediate amputation at the middle of the forearm did not prevent the appearance of metastases in both breasts in four weeks' time, and death from general metastases, especially in the abdominal and thoracic regions, six weeks later. The early diagnosis in this case was very difficult. Intense pain and tenderness closely simulated an inflammatory trouble, especially as it immediately followed an injury. The failure to find pus in this case, continuation of severe pain, the rapid enlargement of the diffuse swelling of the metacarpal bone with the absence of any tuberculous history, should have made the probable diagnosis possible. In every case of doubt, of sarcoma in either the metacarpal or metatarsal bone, a small portion of the growth should be promptly removed for microscopical examination.

These tumors are exceedingly malignant and temporizing is fatal.

Sarcoma of the metatarsal bones is usually mistaken in the early stages for either acute rheumatism or tubercular

arthritis. My own case had been treated for several weeks for acute rheumatism. The diagnosis should have been made from the following points:

(1) The very severe pain, limited in a single, limited area, rather in the bone itself, than along its articular surfaces; (2) the absence of any effusion about the joint and the fact that no other joints or bones were affected; (3) the fact that neither pain nor swelling were affected by large doses of salicylate; (4) the absence of fever; (5) the gradual but constant increase in size.

The diagnosis from tuberculosis could be made from the fact that the patient was a strong, healthy young woman, 26 years of age, who had no family or previous personal history of tuberculosis. The character of the swelling itself differed from that usually found in tubercular osteitis. The swelling was more diffuse, situated near the centre rather than the extremities of the metacarpal bone. There was no inflammatory redness, no adhesion nor caseous degeneration. Again, the pain was much more severe than I have ever witnessed in connection with tubercular osteitis. Amputation of the leg was performed in this case at the junction of the lower and middle third. The patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus immediately after wound healing and the treatment kept up for about four months. I examined her in November, 1906, five years later, and found her in perfect health.

There are two cases in the tables which deserve further notice; they are:

FIRST (Case XXXVI). *Sarcoma of the Femur.* C. C. S., male, aged 42 years, seen in consultation with Dr. L. S. Pilcher in May, 1905. About eight months prior to his admission to the hospital, he had pain in the region of the knee, following a slight wrench while skating. In a few months the pain disappeared and he remained well for ten months and then began to have a return of the pain, which was attributed to rheumatism. In December, 1904, sudden severe pain developed which compelled

him to go to bed; he remained in bed for two months, then was up and about on crutches for three months. There was no limitation of motion in the knee joint, but a tumor developed in the region of the condyles. This gradually increased in size and in May, 1905, Dr. Pilcher removed a portion of the tumor for microscopical examination. The specimen was examined by Dr. Biggs of New York and several pathologists of Brooklyn, all of whom concurred in confirming the clinical diagnosis of sarcoma. Hip-joint amputation was strongly advised both by Dr. Pilcher and myself, but the patient would not give his consent. He left the hospital, and shortly afterward began taking internal "herb medicines" which he obtained from an advertising clairvoyant physician. He soon began to improve, and after a few months was able to walk. Personal examination January 10, 1907, shows a cicatrix 3 inches long and 1½ inches wide over inner condyle of left femur. The femur seems perfectly normal in appearance and the knee-joint movements are normal. Measurement over the condyles shows one-half inch larger than on the other side, but patient states his right knee has always been swollen, due to hip disease when a child. The patient's general health is good and he walks two or three miles a day without a cane.

SECOND (Case XXI). *Periosteal Sarcoma of the Femur.* Miss R., aged 18 years, examined by me on February 15, 1901, in consultation with Dr. Geo. R. Fowler of Brooklyn. The patient had been treated for several weeks for pain and swelling in the middle of the right thigh. Examination showed a swelling, apparently of bony origin, in the middle of the right thigh, fusiform in shape, somewhat tender on pressure. An exploratory operation was performed at the German Hospital in Brooklyn, by Dr. Fowler, who found a tumor 2 to 3 inches in length, situated on the outer aspect of the middle of the right femur, starting apparently from the periosteum. Examination was made by the hospital pathologist, who pronounced it round-celled sarcoma. Hip-joint amputation was advised by Dr. Fowler and myself, but in this case also, the patient and family refused to give their consent. The patient left the hospital and soon began taking some vegetable medicine. The trouble promptly disappeared and she remains perfectly well up to the present date.

Dr. Fowler and myself endeavored to obtain a slide of the

specimen for further examination, but both specimen and slide had become lost and we were unable to confirm the diagnosis.

In view of the short duration and the limited extent of the disease, and the fact that the temperature ranged between 101° and 102°, with considerable pain and tenderness, there is very little doubt that we were dealing with a periostitis rather than a true neoplasm. It would be unfair, however, not to include these two cases, inasmuch as they both fulfilled the test ordinarily applied and accepted as sufficient in such cases, and had amputation been performed, as was advised, we should have had the unquestioned right to class them as operative cures. In the first case I believe the diagnosis was correct, and that the simple exploration with more or less curetting was in the early stage of the myeloid sarcoma sufficient to produce a cure. I have had one case of sarcoma of the lower jaw (myeloid) in which a preliminary operation with curetting resulted in a cure. Such cases furnish strong reasons in favor of the more conservative operations in the myeloid type of sarcoma of the long bones. The other case, I believe, was a case of mistaken diagnosis. Another explanation is that these two cases may have been instances of spontaneous cure. We know that carcinoma in mice shows spontaneous disappearance in many cases, as high as 20 per cent. in some laboratories, and Gaylard has collected about 20 cases of spontaneous cure of carcinoma in man. Dr. Beebe's experiments at the Huntington Fund for Cancer Research show a certain proportion of spontaneous recoveries in sarcoma in dogs, and there is reason to believe the same thing may occur in sarcoma in man, though such cases must be exceedingly rare.

(See Tables I to IV, page 360, et seq.)

FINAL RESULTS.

Ten patients have remained well over three years. One patient with sarcoma of the femur was well five years after hip-joint amputation; 1 of the femur, well after five years, no oper-

ation, medicinal treatment,—diagnosis in this case was probably erroneous; 1, a subperiosteal round-celled sarcoma of the femur with metastases, well after five years, treated with the toxins, without operation; 1 of the tibia remains well eight years after treatment with the mixed toxins, without operation; 1 of the tibia, well ten years following amputation of the thigh; 1 of the tibia, well five and a half years after, then developed metastases in the lung; 1 of the tibia, well two years after, recurrent twice after conservative operation, the tumor disappeared under the toxins and X-rays, patient well at present; 1 of the humerus, well after four years after resection, followed by the mixed toxins; 1 of the radius, well six years after resection; 1 of the ulna, well eight years, then developed extensive abdominal metastases; 1 of metatarsal bone, well five years, amputation of leg, middle and lower third, mixed toxins after operation, four months.

The method of treatment that I would propose as a substitute for the present methods is one that I have been gradually forced to adopt by steadily accumulating mass of evidence in its favor.

As early as 1895, in a case of sarcoma of the fibula, I attempted to save the limb by injections of the erysipelas and bacillus prodigiosus toxins. Although there was some slight improvement, this proved to be only temporary, and three months later I amputated above the knee. The patient died of lung metastases two years later.

In 1899, in a case of sarcoma of the tibia, which had been twice treated by local operation, curetting and chiseling, I again attempted to save the limb before resorting to amputation. This time with better result, as may be seen from the following history of the case:

Spindle-Celled Sarcoma of the Tibia.—F. W. F., male, ætat 27 years, farmer by occupation. F. H. good. No tubercular or syphilitic history. In March, 1897, the patient first noticed a swelling over the middle region of the left tibia. This became

red and gradually increased in size. On November 25, 1898, an exploratory operation was done by Dr. Stewart of Toronto, Canada. The tissue removed was examined by Dr. John Caven, Professor of Pathology at the University of Toronto, who pronounced it spindle-celled sarcoma. Amputation of the leg had been advised. In February, 1899, the patient was referred to me by Professor Caven in the hope of saving the limb by the use of mixed toxins. He was admitted to my service at the General Memorial Hospital. Examination at this time showed a tumor, anteriorly, in the middle portion of the left tibia 3 x 4 inches in size, projecting ½ to ¾ inch above the normal surface. There were two areas of ulceration, the larger being 1 inch in diameter; no enlarged glands could be detected. The patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus and the injections were continued for about two months. At the end of this time the tumor had apparently disappeared and the ulcerations began to fill up with healthy granulations. During his stay at the hospital he had an attack of accidental erysipelas which he undoubtedly contracted from a patient in the ward suffering from erysipelas. The disease extended over the entire leg and thigh and the attack, which was quite severe, lasted for about two weeks. The ulcerations quickly healed up and the patient returned to his home and has been pursuing his regular occupation up to the present time. His health is perfect and he has had no trace of a local or general return of the disease.

Myelosarcoma (Giant-Celled) of Tibia.—K. K., female, 17 years of age. F. H. good; P. H. first noticed pain in ankle in the early part of 1904; then a swelling appeared over the internal malleolus which was painful on pressure. She went to several clinics but got no relief; the trouble was looked upon as tuberculous disease. In September, 1904, she was unable to walk. A large swelling appeared over the internal malleolus, with slight effusion into the joint. October 11, 1904, she was operated upon at the Hospital for Ruptured and Crippled by Dr. V. P. Gibney. A 2¾ inch incision was made and 8 ounces of thick, reddish-brown soft material was removed from the lower end of the tibia. The entire lower third of the tibia was apparently involved, only a thin outer shell remaining; fibula and ankle joint were apparently not involved. Microscopical examination proved the tumor to be myelosarcoma (giant-celled). A large local recurrence took

place and on January 3, 1905, this was curetted and the patient was put upon the X-rays and toxins. Thirty-two injections were given at the Hospital for Ruptured and Crippled, after which she was referred to the General Memorial Hospital, where she remained under treatment until July. The tumor which had recurred after operation seemed to be held in check by the treatment. Her general health improved and she returned to her home. Examination on November 20, 1906, showed the patient in perfect health, walking without cane or crutch.

I had not yet reached the point of advising the toxin treatment in cases of periosteal sarcoma of the femur, because of the extreme malignity of the disease and the possibility of metastases occurring during the period of trial with the toxins. Hence, in these cases I still advised hip-joint amputation in spite of the uniform failures this method had hitherto given me.

In 1902, however, a patient, 19 years of age, was referred to me by Dr. W. R. Townsend, of the Hospital for Ruptured and Crippled, with periosteal round-celled sarcoma involving the lower two-thirds of the femur. Both the patient himself and his family absolutely refused to consider amputation, so that I felt justified in this case to suggest a trial with the toxins. The following is a brief history of the case:

Round-Celled Sub-periosteal Sarcoma of the Femur, Involving Lower Two-thirds of the Shaft.—A. G., 19 years. A tumor in the lower portion of the femur was first noticed in November, 1901. There was no history of trauma. This tumor gradually increased in size and was accompanied by loss of weight and deterioration of general health. The patient was referred to me on February 5, 1902, by Dr. W. R. Townsend of the Hospital for Ruptured and Crippled. Physical examination at that time showed a large tumor, occupying the entire lower two-thirds of the left femur, fusiform in shape and most prominent in the region of the condyles. On the outer aspect of the thigh, about 1½ inch above the joint, there was a soft fluctuating area. There was slight impairment of the functions of the joint, but the joint itself was not involved. An incision was made under ether anæsthesia over the fluctuating area and 3 ounces of clear serum,

similar to that found in sarcoma of the bone which has undergone cystic degeneration, was evacuated. By means of a curette a considerable portion of typically sarcomatous tissue was removed. This was examined microscopically by Drs. E. K. Dunham of Bellevue Hospital and B. H. Buxton of Cornell University, and pronounced small, round-celled sarcoma. The patient absolutely refused amputation at the hip joint, which I strongly urged.

I was at this time just beginning to try the X-ray treatment of inoperable malignant tumors, and gave the patient four exposures a week. At the end of one month the tumor had decreased in size one inch. The treatment was continued during the entire summer and fall of 1902. The patient gained considerably in weight, but in December, 1902, developed a metastatic tumor in the left pectoral region. This grew very rapidly, and when it had reached the size and thickness of the hand, I removed it with scissors and curette, under ether anæsthesia. Shortly after this, a large tumor, about the size of a child's head, developed in the iliolumbar region on the right side; it filled up the whole iliac fossa and extended up to the ribs. I then put the patient upon large doses of the mixed toxins of erysipelas and bacillus prodigiosus. After about four weeks the tumor in the iliolumbar region began to soften and break down. As soon as fluctuation became distinct, I made a posterior opening and evacuated a large amount of necrotic tumor tissue. A tube was kept in place and the sinus drained for about a year. No X-ray treatment was applied to the iliolumbar tumor. The sinus in the leg has persisted up to the present time; examinations of several curettings have failed to show any evidence of sarcoma. At the present time, five years from the beginning of the treatment, and four years since the toxins were begun for the metastatic tumors, the patient has remained in apparently perfect health and there is no longer any evidence of sarcoma to be found.

Up to the present time I have been able to collect 12 cases of sarcoma of the long bones: 3 personal cases and 9 reported by other observers, in which the use of the toxins has rendered amputation unnecessary and the limb has been saved.

In 8 of these cases the sarcoma was of the round-celled variety, in 2 spindle-celled and in 2 no microscopical exam-

ination was made, but amputation had been strongly advised in both instances by prominent surgeons.

The period of observation in these cases is most important: 8 were alive and well and free from recurrence from three to eight years, 1 two years, 1 one year; 2 other cases have been observed less than six months.

In 5 of these cases the tibia was involved; in 1 the fibula; in 3 the femur; in 1 the radius; in 1 the humerus (not long bone). In every one of these amputation had been seriously considered, but it was thought justifiable to give the toxins a trial before resorting to operation.

These cases seem to me sufficient in number and the period of observation sufficiently extended to justify us in advocating a course of treatment with the mixed toxins in practically all cases of sarcoma involving the long bones before sacrificing the limb.

It is important to note that in several of these cases, particularly the two cases of sarcoma of the femur, involving the upper end, the disease was so extensive that hip-joint amputation was impossible. In both of these cases the diagnosis had been confirmed by microscopical examination.

If we could offer the patient reasonable certainty of life by amputating the limb, there might be some ground for hesitating to try the toxin treatment before amputation; but, in the face of our inability to save the life of the patient except in a very small minority of cases, I feel that we are risking little in giving the patient the benefit of a brief trial with the mixed toxins. A period of three to four weeks will almost always be sufficient to determine the probable success or failure of the treatment. If a tumor continues to increase in size during this period, then I would not prolong it to the full four weeks, but would amputate at once, and then as soon as practicable continue the toxins as a prophylactic against recurrence. With this important exception I would limit the use of the toxins to *inoperable* sarcoma, which has always been my custom in the past. About 10 to 12 per cent. of such cases hopeless from any other standpoint, have been successful.

The use of the toxins is no longer in the experimental stage, as I have attempted to show in my paper, loc. cit. (*Amer. Jour. Med. Sci.*, March, 1906). In this paper I gave the records of 36 personal cases of inoperable sarcoma in which the toxins have been used with success during the last fourteen years. Twenty-six of these cases were well and free from recurrence from three to thirteen years; 21 from five to thirteen years. The same paper contains a tabulated report of 60 cases successfully treated by other surgeons, 27 of which were alive and well from three to twelve years, which is sufficient refutation, I think, of the statement occasionally made, that the method has been successful only in the hands of its author.

The toxins used in my personal cases since 1894 up to a year ago have been prepared by Prof. B. H. Buxton, of the Loomis Laboratory (Cornell University Medical School). During the last year the toxins have been prepared by Dr. Martha Tracy, of the Huntington Cancer Research Fund, under Dr. Buxton's direction. Dr. Tracy has, I think, made an improvement over the older method of preparation, which consisting in growing the bacillus prodigiosus in the same bouillon with the streptococcus of erysipelas. The growth of the prodigiosus was always variable and it was difficult to get a standard preparation. Dr. Tracy has, during the last year, grown the prodigiosus separately, sterilized with just sufficient heat to destroy the bacilli, reducing the growth to a dry powder and then adding a certain definite amount by weight to each ounce of the streptococcus broth. This preparation is much more stable and has proved somewhat more powerful in its action, requiring smaller doses, and the actual results in inoperable sarcoma thus far have shown a distinct improvement over those obtained with the older preparation. My own clinical experience, apparently confirmed by Dr. Tracy's experiments upon sarcoma in dogs, has proven that the bacillus prodigiosus itself exerts a powerful inhibitory action upon the growth of sarcoma, although I originally added it to the erysipelas with the sole idea of intensifying the action of the streptococcus of erysipelas.

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I. SARCOMA OF THE FEMUR.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
1	1896	F.	11	Lower third. Periosteal.	8 months.	Yes. Fell down steps, injured knee.	Spindle celled.	Hip joint amputation. (Coley.)	Recovery.	Not traced beyond 6 months.
2	1897	F.	13	Lower Third. Central.	8 months.	No trauma.	Round sarcoma.	Hip joint. (Coley.)	Recovery.	Died of metastasis in 1½ years.
3	1897	M.	6	Lower half. Periosteal.	6 months.	No.	Round celled.	Hip joint. (Coley.)	Recovery.	Death. Lung metastasis, 6 months.
4	1898	M.	44	Lower third. Central.	2 to 3 months.	Yes. Fracture from kick of horse.	Round celled.	Hip joint. (Coley.)	Recovery.	Death. Lung metastasis, 8 months.
5	1901	F.	50	Upper third. Periosteal.	6 months. Excision. Recurrence.	No.	Round celled. Central.	Hip joint. (Coley.) Toxins 6 weeks after operation.	Recovery.	Death. Metastasis, 8 months.
6	1904	M.	28	Lower third. Central.		Yes.	Round celled.	Amputation upper third. Recurrence in stump. Hip joint. (Coley.)	Recovery.	Toxins after operation. Recurrence. Death, 6 months.
7	1899	F.	8	Lower half. Periosteal.	4 months.		Round celled.	Hip joint. (Bull.)	Recovery.	Death. Metastasis, 6 months.
8	1898	F.	13	Lower third. Myelogenous.	7 months.	No.	Round celled.	Hip joint. (Rushmore.)	Recovery.	Well 5 years later.
9	1897	M.	25	Lower third. Periosteal.	3 months.	Yes.	Round celled.	Hip joint. (Bull.)	Recovery.	Recurred. (Toxins.) Metastasis. Death, 1 year.
10	1905	M.	15	Lower third. Periosteal.	4 months.		Round celled.	Hip joint. (Johns, Markoe.)	Recovery.	Toxins after operation, 3 months. Recurrence. Death, 1 year, Metastasis.
11	1902	M.	16	Lower third. Periosteal.			Round celled.	Hip joint. (Roosevelt Hospital.)	Recovery.	Recurrence. Local toxins. Not traced.

12	1901	M.	45	Middle. Periosteal.	3 to 4 months.	No.	Spindle celled.	High amputation (Coley) followed by toxins. Later hip joint. (Bloom.)	Recovery.	Recurrence. Death, 2 years. Metastasis.
13	1896	F.	26	Lower third. Central.	3 months.	Yes. Strain.	Mixed celled.	High amputation. (Coley.)	Recovery.	Death 4 months. Metastases of lungs.
14	1906	F.	20	Lower third. Central.	1 year.	No.	Round celled. Giant celled.	Amputation below trochanter. (Coley.)	Recovery.	Toxins after operation. Gain 39 pounds. Well February, 1907. 9 months.
15	1906	F.	16	Lower third. Central.	3 months.	No.	Round celled.	Amputation below trochanter. (Coley.)	Recovery.	Toxins after operation. Gain 30 pounds. Well February, 1907. 9 months.
16	1906	F.	13	Lower third. Central.		No.	Round celled.	Amputation below trochanter. (Whitman Gallie.)	Recovery.	Toxins after operation. Well at present. February, 1907.
17	1903	M.	43	Lower third. Periosteal.	6 months.	Yes. Fall, few months before.	Round celled.	Amputation, hip joint.	Recovery. Recurred in six months in stump.	Recurrence. Treated with toxins 3 weeks, no effect. Died later. About 6 months.
18	1906	M.	32	Lower third. Central.	6 months.	No trauma.	Round celled.	Amputation below trochanter. (Erdman).	Recovery.	Toxins begun 2 months after operation. No recurrence at present.
19	1901	M.	50	Upper third.	6 months.	Yes.	Round celled.	Exploratory operation 1902.	Too extensive for amputation.	Toxins for few weeks Little effect.
20	1902	M.	16	Lower third. Periosteal.	4 months.	No.		Amputation advised. Refused.	None.	Not traced.
21	1901	F.	18	Middle. Periosteal.	6 weeks.	No.	Round celled.	Hip joint amputation advised. Refused. Took some vegetable medicine from a "cancer specialist."	Recovery.	Well at present, 5 years later. (Diagnosis doubtful.)

I. SARCOMA OF THE FEMUR.—*Continued.*

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
22	1906	M.	38	Upper third. Central.	6 months.	Yes.	Round celled. Giant celled.	Tumor extended into groin and iliac fossa. Inoperable. 7 inches larger than other side. Mixed toxins October 21, 1906. (Foote.)	Rapid improvement. Large masses of tumor sloughed out.	Tumor nearly disappeared, November 21, 1906. Patient gradually grew weaker and died early in December, 1906.
23	1905	M.		Lower third. Periosteal.	5 years.	No.	Round celled.	Amputation below trochanter. (Bull.)	Recovery.	Metastasis in face and head 4 months later. Died 7 months after operation.
24	1891	F.	16	Lower third. Periosteal.	1 year.		Round celled.	Inoculated with living cultures of erysipelas; could not produce an attack.	Rapid progress of disease.	Death, 4 months. Exhaustion.
25	1894	F.	21 mos.	Upper end involving ilium.	6 weeks.		Round celled.	No treatment.		Death. 3 months.
26	1902	F.	25	Middle third. Myeloid.	6 months.	No.	Round celled. Myeloid.	Too far advanced for amputation. Toxins a few weeks.	Little effect.	Death.
27	1895	F.	22	Lower end. Periosteal.			Round celled.	Hip joint amputated. (Walker.)	Recovery.	Not traced.
28	1905	F.	13	Lower end.	4 months.	Trauma.	Round celled.	Too far advanced for hip joint operation. Toxins for 4 weeks.	Slight improvement.	Not traced.
29	1902	M.	18	Lower two-thirds	6 months.	Yes.	Round celled.	Amputation hip joint advised. Refused. X-ray followed by metastases. Toxins then used.	Recovery. Tumors in leg, pectoral and ilio-lumbar regions disappeared.	Well February, 1907. Four and one half years.

30	1898	F.	19	Upper end. Central.	9 months.	No trauma.	Round celled. (Giant.)	Tumor inoperable. Exploratory incision. Specimen removed for microscopic examination.	Toxins (Elsburg). Two to three months. Arsenic injections.	Final recovery. Union of the spontaneous fracture. Well six years later.
31	1906	F.	34	Upper third.	6 months.	No.	No microscopic examination.	No operation. Toxins. May, 1906.	Improvement.	Still under treatment.
32	1906	M.	10	Middle fusiform. Periosteal.	5 months.	No.	Periosteal; Small round celled.	Exploratory incision. Nov. 27, 1906.	Put upon mixed toxins at once.	Under treatment. Feb. 1907. Marked decrease in size; gaining weight.
33	1904	M.	15	Lower third. Periosteal.	Developed few days after fall.	Yes. Fall upon knee. Few days.	Round celled.	No operation. Toxins short time.	No marked improvement.	Not traced.
34	1901	M.	23	Lower end. Periosteal.	1 year.	Yes. 1 year after injury. Fall.	No microscopic examination.	No treatment. Amputation advised.	Refused.	Not traced.
35	1905	M.	42	Lower end. Myeloid.	8 months.	Strain several months before.	Round celled.	Exploratory operation, Dr. Pilcher. Amputation advised. May, 1905.	Slow disappearance of growth.	Examination January 10, 1907. Femur, normal appearance. No evidence of tumor present. (*Vid.* text.)
36	1907	M.	12	Middle and lower third.	3 weeks.	Kick. Developed 1 week after.	Round celled.	Exploratory operation January 15, 1907. Dr. W. R. Townsend.	Put on mixed toxins Jan. 17, 1907.	Decreased 1¼ in. in 10 days. Feb. 10, 1907, beginning to increase in size. Amputation below trochanter, Feb. 15, '07.

II. SARCOMA OF THE TIBIA.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
37	1907	F.	29	Upper tibia.	Second year.	Yes. Fall.	Round celled. Myeloid.	Exploratory operation. Jan. 17, '07. Dr. Gibney.	Toxins used to save limb.	Under treatment, Feb. 10, '07. Decrease in size
38	1895	F.	11	Middle tibia. Periosteal.	1 month. 3 inches increase in size.	Fall 3 months before.	Round celled. Very vascular.	Amputation urged. Refused. Toxins 4 doses only.	Lost sight of.	

II. SARCOMA OF THE TIBIA.—*Continued.*

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
39	1896	F.	24	Upper end. Central.	4 months.	Yes. Fall down stairs. Tumor very soon after.	Round celled. Small round.	Amputation 1895. (Coley.) Lower third thigh.	Recovery.	Well 10 years after.
40	1899	M.	27	Middle and upper third. Tibia.	1 year and 11 months.	No trauma.	Spindle celled. Periosteal.	Mixed toxins of erysipelas and B. prodigiosus. 2 months.	Tumor entirely disappeared.	Patient well at present, 8 years later.
41	1897	M.	12	Upper third. Tibia. Fusiform Periosteal.	1 month.	Fall. Developed soon after few days.	Round celled.	Amputation of thigh. (Bull.) 1895.	Recovery.	Not traced.
42	1902	F.	17	Lower end. Tibia. Central.	6 months. Pain before swelling.	No trauma.	Round celled. Giant celled.	Two operations, Dr. Gibney, October 1904, and January 1905. Curetting and chiseling out of bone. Rapid recurrence.	Put upon mixed toxins of erysipelas and B. prodigiosus with x-ray. Jan. 1905. (Coley.)	Treatment continued till July 1905. Tumor disappeared. Patient well January, 1907.
43	1906	M.	26	Lower two-thirds. Central.	3-4 years.	Yes. Cystic cavity. Lower half of tibia a shell.	Round celled.	Toxins 3 months. June, 1906. Tumor decreased in size. Toxins. Much improved.	Much improved	Not traced.
44	1894	F.	35	Tibia. Middle.	6 months.	No trauma.	Spindle celled. Periosteal.	Amputation above knee. (McBurney). June 27, 1899.	Recovery.	Spinal recurrence; metastasis. 7 mos. Death.
45	1904	M.	10	Tibia. Middle. Upper third.		Trauma. 1 year before.		Amputation advised. Refused.		Not traced.
46	1905	M.	20	Middle. Tibia.	4 years.	Trauma. Tumor 3 inches larger than other side.		Amputation advised. Refused. March, 1905.		Not traced.

47	1906	M.	32	Middle. Central.	1 year.	Yes.	Round celled.	Amputation of upper third thigh. May 1906.	Recovery.	Local and general recurrence. Lung pleura and rib. 4 mos. Died Nov. 1906.
48	1896	F.	50	Lower end.	6 months.	Yes.	Round celled.	Amputation above knee (Coley).	Recovery.	Not traced.
49	1900	F.	26	Upper end. Central.	Pain and lameness 1 year before trauma.	Trauma. Fall 1½ years before.	Round celled. Central.	Amputation middle thigh. (Bull.) February 12, 1900.	Recovery.	Metastasis, lung and pleura. 5 years and 6 months. Death 6 years six months. Toxins used after generalization; little effect.

III. SARCOMA OF THE HUMERUS.

Case.	Date.	Sex.	Age.	Locality.	Duration	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
50	1900	F.	37	Humerus.	4 months.	No trauma.		April, 1900. Operation.	Recovery.	Recurred. 5 months.
51	1901	M.	17	Left humerus. Upper end.	6 months.	No trauma.	Round celled. Periosteal. No giant cells.	Exploratory incision and amputation of shoulder joint. Dr. Bull. May, 1901.	Recovery. Local recurrence 3 weeks.	Mixed toxins of erysipelas and B. prodigosus begun and continued 3 months. Recurrent. Tumor disappeared. Died November, 1901, 5 months after operation. Metastasis.
52	1900	M.	18	Left fusiform, Right Humerus.	6 months. Glands of neck.	Trauma. Brick fell 3 stories. Tumor at once.	Round celled. Periosteal.	6 months after first noted. Amputation, Dr. George Fowler, March, 1900. Metastases few weeks later.	Recovery. Metastasis quickly followed with larger tumor in right humerus. Aug. 1900.	Died soon.

III. SARCOMA OF THE HUMERUS.—*Continued.*

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
53	1901	M.	45	Humerus. Right and left. Middle central.	2½ months. Spontaneous fracture.	No trauma.	Round celled. Central.	Amputation of shoulder (Dr. Bull), May, 1900	Recovery. Severe neuralgic pains in chest five weeks later.	Mixed toxins 5 weeks. Pain increased September 1, 1901. Spontaneous fracture of other humerus. Died October, 1901, 6 months after first symptoms.
54	1905	M.	14	Humerus. Left. Periosteal.	5 months. Very large.	None noted but was a football player.	Periosteal (x-ray photo). No microscopic examination.	Amputation advised but refused. Tried X-ray against advice.		Died February, 1906, 10 months from first symptoms.
55	1904	M.	28	Humerus. Left. Axillary glands. Periosteal.	4 months. Very large. Size of a child's head.	No trauma.	Periosteal. Round celled.	Amputation of shoulder, part of clavicle and scapula, February 5, 1904. (Coley.)	Recovery. Recurring three months later.	Mixed toxins tried. No effect. Spinal and general metastasis. Died June, 1904 (7 months).
56	1901	F.	38	Right humerus, upper end.		Strain.	Chondro-sarcoma.	Excision of tumor.	Recovery.	Not traced.
57	1899	M.	58	Left humerus. Upper end.	6 months.	Trauma. 1 month before.	No microscopic examination.	Amputation of shoulder joint advised. Refused.		Not traced.
58	1906	M.	22	Right humerus, Upper end. Periosteal.	4 months.	No trauma.	Round celled.	No operation.	No treatment.	Exceedingly rapid growth size of adult head in 4 months. Death 5 months from start. (*Vide* text and illustrations.
59	1906	F.	13	Upper end. Joint not involved. Periosteal.	3 months.	No trauma. Pain first, swelling soon after.	Round celled.	Preliminary use of mixed toxins, begun November 26, 1906. 3 weeks. Improved at first, later no control.	Amputation advised. Refused.	Patient left hospital on December 23, 1906.

60	1906	F.	25	Right humerus. Periosteal.	6 months.	No trauma.	Periosteal.	Amputation of shoulder advised. Operation performed by another surgeon. (Campbell.)	Death from shock.	
61	1897	M.	20 mos.	Left humerus. Nearly whole bone. Fusiform.	1 month.	No trauma.	Periosteal.	Very rapid growth. 3 times size other arm in one month. Veins dilated. Joint not involved.	Amputation refused.	Not traced.
62	1902	F.	Adult.	Right humerus. Round celled. Myeloid.	Pain and stiffness. 4 months.	Yes. Fall 9 months before.	Round celled. Myeloid.	Removed head of bone, tip of coracoid process, part of glenoid cavity. Dr. J. Babst Blake of Boston.	Treated with mixed toxins after operation.	Patient shown by Dr. Blake at the American Medical Association, Boston, June, 1906. Well. 9 years.

IV. SARCOMA OF THE RADIUS, ULNA, AND FIBULA.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
63	1898	F.	24	Radius. Lower third.				Operation advised. Refused.		Not traced.
64	1902	F.	29	Lower third. Right radius. No glands. Central.	8 months.	Blow. Pain 3 months later. 5 months tumor.	Round Celled. (Giant.)	First operation September, 1900 (Dr. Hibbs). Second operation, January, 1902. Recurrence. Amputation advised.		Patient alive and well at present. Examined by Dr. Coley, Nov. 28, 1906.
65	1906	F.	31	Radius, left, lower end. No glands. Periosteal.	1 year pain. 8 months tumor.	No trauma.	Round celled.	Amputation. (Coley). September 14, 1906. Mixed toxins, October 1, 1906, as prophylactic.	Recovery.	Well at present, Feb. 1907.

IV. SARCOMA OF THE RADIUS, ULNA, AND FIBULA.—*Continued.*

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
66	1906	M.	25	Ulna. Middle. No glands affected.		Yes. Green-stick fracture 7 years before. Slight swelling soon after. Gradual increase in size.	Spindle celled.	Amputation of middle arm, 1899. George Tully Vaughn, Washington, D. C.	Recovery. Well 7 years. Recurred in abdomen.	Spring 1906, noticed abdomen increasing in size. No pain. Oct. 1906, whole abdomen filled with tumors of various sizes. Put on mixed toxins Nov. 1906. Tumors nearly disappeared Feb., 1907.
67	1906	F.	28	Ulna. Lower end.		No.		No treatment.	Lung and pleural metastasis.	Died in less than 1 year from beginning of symptoms.
68	1896	F.	52	Fibula. Upper end. Joint not involved. Periosteal.	Pain 3 years. Swelling 2 years.	Fibula. No trauma.	Spindle celled. Periosteal.	Toxins, 6 weeks. Tumor decreased 1 inch. Later increased. Amputation, (Coley), November, 1895.	Recovery.	Died of lung metastasis 2 years later.
69		F.	52	Fibula. Upper end. Not involved joint. Periosteal.	2 years.	Trauma. Fall. Tumor developed 3 months later.		1898. Amputation advised. Refused.		Not traced.
70	1890	F.	18	Third metacarpal. Periosteal.	4 months.	Blow on back of hand. Tumor developed immediately after.	Metacarpal. Round celled. Alveolar.	Exploratory incision. Amputation middle forearm.	Recovery.	Metastasis, both breast and abdomen in 4 weeks. Died 8 weeks later.
71	1901	F.	25	Second metatarsal bone. Region, periosteal.	Few months.	No.	Round celled.	Amputation. Leg, Middle.	Recovery.	Mixed toxins 6 mos. Patient well 5 years after operation.

SUCCESSFUL ANTERIOR THORACO-BRONCHOTOMY FOR A FOREIGN BODY IMPACTED IN THE BRONCHUS.

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THE literature of operations directed to the removal of impacted foreign bodies in the bronchi, at least such of it as is available to the writer, is exceedingly limited, both as to extent and detail. Such as could be found, dealt with the subject in an indefinite and unsatisfactory manner. In most of the cases cited, no attempt was made to indicate the site of the foreign body, the method of approach made use of, or the conditions which governed the operator in his choice of a method of attack.

The operation of choice has apparently been the more complicated posterior bronchotomy, the reason for which has been that there is less danger of pneumothorax. The few reports of anterior bronchotomy that the writer was able to find, led to the belief that the report of this case might be of interest.

History.—J. S., male, age 6 years, 9 months, about noon on August 5, 1904, while playing, inspired a small metal collar button of the type in common use by laundrymen, which he had in his mouth. He became very much frightened, ran into the house and began to cough. The cough lasted only a few minutes, and the family, thinking that he had swallowed the button, paid no more attention to it. About five o'clock he had a sudden severe paroxysm of coughing and became cyanotic. His mother shook him and the coughing ceased. The boy declared that he felt something move in his "neck." During the night he had several severe paroxysms, became cyanotic, and the dyspnœa was marked.

The next morning he was taken to the family phyisican,

Dr. G. M. Studebaker, who, after examination, referred the patient to me.

Examination on August 6, 1904, at 9 A.M., showed a fairly well developed boy. The respirations were easy, though slightly limited on the right side. There was some dulness on the right side, anteriorly and posteriorly. The respiratory murmur was very much diminished posteriorly, and almost absent anteriorly. The temperature, pulse and respiration were normal. There was neither cough nor tenderness. Examination of pharynx and larynx was negative. Fluoroscopic examination of thorax was also negative. A diagnosis of a foreign body in the right bronchus was made and operation advised. The parents took the boy home and at first refused operation, but during the night of the sixth his condition became so alarming, from great difficulty in breathing and paroxysms of coughing, with cyanosis, that they consented to an operation.

On admission to the Hamot Hospital on August 7, 1904, at 10 A.M., the temperature was 98⅘°, the pulse 104 and the respirations 22. Examination showed a total absence of respiratory murmur on the right side, no cyanosis, respirations easy, movement limited on the right side.

Operation August 7, 1904, at 10.30 A.M. Chloroform anæsthesia.

Through a low tracheotomy wound a large silver probe was passed and the obstruction could be felt in the right primary bronchus. An attempt was made to remove the button by the use of long dressing forceps, silver wire loops and a curette, but every effort failed to move or grasp it. It was discovered later that the small end of the button was directed downward and the large end was firmly imbedded in the bronchus, the mucous membrane being very much swollen. As it was impossible to remove the button in this manner, I decided to open the thorax.

During the operation on the thorax chloroform was administered through the tracheotomy wound which was held open by a silk suture passed through the wall of the trachea, the chloroform being dropped on gauze held a short distance from the wound.

A curved incision was made, beginning over the second rib just beneath the middle of the clavicle, and carried downward and inward to within an inch of the right margin of the sternum, thence outward to the level of the fifth rib an inch to the inner

FIG. 1.—Showing patient after recovery from thoraco-bronchotomy for foreign body in bronchus.

side of the nipple. The cartilages of the third and fourth ribs were cut about one-half inch from their sternal attachment and an osteoplastic flap made by breaking the third and fourth ribs. Through this opening good access to the lung was secured. The lung was found almost entirely collapsed, and the button could be palpated easily through the lung. There was a slight movement of the bronchus with the respiratory act; an assistant by hooking his finger under the bronchus controlled the movements easily. As it was impossible to roll back the overlying lung an incision about one-half inch in length was made with a scalpel through the lung into the bronchus. There was practically no hæmorrhage from the lung or bronchus. A pair of artery clamps, introduced through the incision, grasped the button and by a twisting motion it was removed. All of this was done with lung within the thorax. The lung and bronchus were dropped into place, no sutures being inserted. The thoracic wall flap was replaced and silkworm gut sutures were inserted through the muscles. No drainage was used and no fluid injected into the pleural cavity. The tracheotomy wound was closed with sutures, but on account of great emphysema of the cellular tissues about the larynx and neck, causing dyspnœa, which developed shortly after the operation was completed, a tracheotomy tube was inserted. The patient was in considerable shock before the operation on the thorax was begun and the opening of the pleural cavity did not apparently increase the condition. Normal salt solution was injected into a vein and the patient rallied slowly. There was intense tracheal irritation, and severe paroxysms of coughing often expelled the tracheal tube.

At 4 P.M. the temperature was 99°; pulse, 140; respirations, 26. At 8 P.M. the temperature was 102°; pulse, 160; respirations, 40. The dressings were saturated with a slightly blood-stained serous discharge. When these were changed it was noticed that with each inspiration there was an escape of air from the pleural cavity. On ausculation a distinct whistling murmur could be heard, coincident with inspiration, which was caused, probably, by the escape of air through the wound in the lung and bronchus. The next day the temperature varied from 100⅘ to 102⅕; pulse, 120 to 140; respiration, 36 to 48. A croup kettle was kept boiling under a tent over the bed and the paroxysms of coughing became less severe. Air no longer escaped from the thoracic wound. The right side of the thorax

was tympanitic, a whistling murmur being heard on inspiration, though not as distinctly as on the previous night. Over the base of the left lung there was slight dulness and breathing almost bronchial in character.

At the end of 48 hours the highest temperature was 101; pulse 116 to 128; respirations, 38 to 56. As the subcutaneous emphysema had disappeared, the tracheal tube was removed and the wound closed with adhesive straps. Healed on sixth day.

There was a gradual improvement in the pulmonary condition; the tympanitic area gradually decreased and the respiratory murmur returned. There was no infection of the pleura, the thoracic wall healing without incident.

On the tenth day the patient was taught to blow water from one bottle to another, and, with this exercise, the lung rapidly expanded. The respiratory sounds were normal on the date of discharge from the hospital, August 26, 1904.

Examination 18 months after operation showed a slight depression over the site of operation on the thorax, expansion equal and good, normal respiratory sounds.

The exact localization of the foreign body, made possible by the exploration through the tracheotomy wound, greatly facilitated the subsequent steps in the operation, the time that would have otherwise been spent in searching for the obstruction was saved to the patient. Unfortunately, too much time—over an hour—was expended in fruitless attempts at removal by way of the trachea. In any future cases where the foreign body was impacted below the bifurcation of trachea, I should do the tracheotomy with greater hope of ascertaining the exact location by that means than of being able to remove the obstruction. Had the button been in such a position that it would have been possible to grasp it with forceps it is questionable if the injury done the bronchus by forcible dislodgement would not have been more disastrous than the bronchotomy.

While it is dangerous to draw conclusions from one case, the fact that forty-eight hours elapsed between the inspiration of the button and its removal and that the patient apparently did not suffer from the delay, might suggest the advisability of waiting not longer than 48 hours for spontaneous delivery.

THE SURGICAL TREATMENT OF EMPYEMA.*

BY SAMUEL LLOYD, M.D.,

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FOUR different methods of operating upon empyema are usually described: First, aspiration or paracentesis; second, thoracotomy with or without resection of a rib; third, the Estlander or Schede operation; and, fourth, the Fowler-Delorme method of decortication of the lung. To these must be added one recently suggested by Dr. Joseph Ransohoff, of Cincinnati, in the ANNALS OF SURGERY, April, 1906, which is simply a modification of the last method. This he calls "Discission of the Pulmonary Pleura." It consists of "gridironing" the pulmonary pleura with many parallel incisions removed from each other about a quarter of an inch, and crossing these obliquely, or at right angles, with other parallel cuts.

Of the first two methods little need be said at this time. They are of use in recent cases where the lung is not permanently collapsed and bound down, and will, if the lung expands, as it frequently does in these early cases of operation, result in a prompt and satisfactory cure. The other three methods are intended for the chronic cases of empyema where the lung has collapsed, and where its expansion to fill the pleural cavity is impossible unless some method is adopted to allow the chest wall to fall in against the pulmonary pleura and become adherent to it, in order to close the suppurating cavity, or, as in the last two operations, the lung itself is made to expand so as to fill the suppurating space.

All these methods are based upon the idea that when the

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lung has once completely collapsed and become firmly fixed the pulmonary pleura has lost its expansibility, owing to inflammatory thickening. so that it will not allow a sufficient amount of re-expansion to permit the pulmonary and parietal surfaces to come into contact. It is now over fifteen years since I began to experiment on these cases in order to determine if there was not some way to bring about this complete expansion of the lung without extensive and mutilating operations upon the chest wall. In 1893, when Fowler and Delorme suggested their method, I discontinued experimental work for a short time and adopted the method of decortication, with the idea that this furnished the best solution of the problem. It was not long, however, before I was convinced that the difficulties attending the freeing of the lung from its pleural covering were so great, and the result following the attempt was so often unsatisfactory, that I took up again the experimental work.

Tillman has said that " if in cases of old empyemata the lung, in consequence of prolonged compression, is no longer capable of expansion, the abscess cavity in the thorax cannot completely heal and an empyemic fistula persists, as the rigid bony wall of the thorax does not yield to the cicatricial contraction. In the most severe cases the involved lung is found firmly contracted, the size of a fist, in the upper part of the pleural cavity. In these cases healing can only be secured by a sufficient resection of the ribs to enable the thoracic wall to yield and thus follow the cicatricial contraction." And Dennis, in his System of Surgery, also makes the statement that " in cases of empyema of long duration . . . the lung is fixed and cannot expand, the pleura is adherent and inelastic, and the chest is prevented from collapsing; and thus a cavity is permanently formed, the obliteration of which is necessary to effect a cure."

On the other hand, Forcheimer, in his recent work on the Prophylaxis and Treatment of Internal Diseases, says that " as a matter of fact we do not find the lung collapsed in opening the chest for empyema, simply because the lung is always

held by pleural adhesions"; but he does not say that frequently in these chronic cases we find the lung pushed up and held in the apex, as Tillman says, or else pushed inward and backward, and reduced to a ribbon-like mass, running parallel to the spinal column and attached firmly from apex to diaphragm in such a way that expansion is practically impossible. Forcheimer also makes the statement that "Schede's operation would be uncalled for if the adhesions could be removed in some other way."

All sorts of devices have been invented in order to increase the intrapleural pressure and so cause the lung to expand. These undoubtedly have their place in those cases where the adhesions are few in number and recent in formation, so that they may yield readily to an increased pressure from without and the natural pressure from within the lung itself during respiration. One of my medical colleagues insists that any radical operation looking to a release of the lung from its adhesions is absolutely wrong; because he claims that as they contract they pull the lung nearer to the rib surfaces and so aid expansion.

Surgeons, however, who have had the opportunity of examining these cases as they occur upon the operating table, will recognize the fact that the lung can no more get away from these adherent bands than Gulliver could rise from the cords of the Lilliputians.

Von Bergman emphasizes the statement that we have all been taught by the physiologists, that if the opening in the pleural cavity is smaller than the diameter of the main bronchus the lung will again take part in normal respiration. His explanation of this is that the air will enter the lung during inspiration through the main bronchus with greater ease than through the opening in the chest wall, so that the collapsed lung is obliged to distend during inspiration. But if we agree to this statement, it is impossible for us to do any work in the pleural cavity which involves a larger opening than the diameter of the main bronchus, without having a collapse of the lung.

Dennis also says that the pleural surface is insensitive, since it is changed into the wall of an abscess cavity.

It is evident, therefore, that if we are going to make a success of any method of operating that calls for a re-expansion of the collapsed lung, it is necessary for us to invent either some method of operating in a vacuum, such as Sauerbruch's box, or prove that there is some way of bringing about expansion in spite of large openings in the chest wall, and in spite of the

These were the difficulties that confronted me in the beginning of my work. One of the earliest facts, however, that impressed itself upon me was that the statement in regard to the insensitiveness of the pleura was incorrect. It is perfectly true that under complete anæsthesia we do not get a response to an irritation of the pleura; but this is not true, even when the pleura is markedly thickened and covered with plastic lymph, if the anæsthesia is incomplete.

The next question that we had to determine was that of the elasticity of the pleura. If the generally accepted statements were correct, that the pleura lost its elasticity in consequence of the thickening and the inflammatory deposits upon its surface, one would be obliged to adopt the methods of Fowler, Delorme, or Ransohoff, and in those cases where success did not result from these methods recourse would have to be had to the Estlander or Schede method.

We were able to demonstrate very early in our experimental work that these facts were incorrect.

Having demonstrated that these preceding statements were true—that is, that the pleura in these cases was not insensitive, and that it was still capable of expansion—the difficulty which presented itself was the physiological statement that with an opening larger than the diameter of the main bronchus, the atmospheric pressure from without alone would be sufficient to keep the lung in a state of collapse, and in that way our efforts to fill the abscess cavity by a proper expansion of the lung itself would be impossible.

We soon recognized that this was true in all of our fully narcotized patients, and it was by working on these facts on

the living subject that we were able to perfect the method of operating that we have now employed for a number of years.

The opening in the chest is made in the usual way, and should take in from one to three or four ribs, according to the size of the cavity and the difficulty of reaching the collapsed lung. In young children, one rib is usually sufficient; in adults, from three to four are necessary. The piece removed should be from 2½ to 3 inches in length, and as a general rule the sixth, seventh, and eighth are selected. The pleura is incised, and the accumulated fluid is allowed to drain away gradually at first. In all of these cases ether is the anæsthetic of choice in my hands, for the reason that we can have the patient under complete anæsthesia until the ribs are removed, and the effects of the ether narcosis last longer than the other anæsthetics after stopping the administration. Before opening the pleura, the anæsthetic should be completely stopped, in order that if we get a sudden expansion of the lung by its breaking away from its retaining adhesions we may not get an overdose of the anæsthetic, and in order that during the remainder of the operation the patient may be gradually coming out from the effects of the anæsthetic. As soon as the fluid has drained away, the opening in the pleura is made sufficiently large to enable the operator to make a thorough exploration of the whole pleural cavity, and to accurately locate the position of the collapsed lung. If there are large masses of coagulated lymph filling the cavity or adhering to the pleura, they should be at once scraped away, using a curette if necessary. The finger is then swept upward, if the lung is in the apex, until its margin is recognized, and a separation of the adhesions is carried on in exactly the same way that we separate the adhesions in the peritoneum. If these adhesions are so firm that they will not yield readily to the sweep of the finger along the pleural surfaces, the lung should be raised and a curved periosteotome swept along the parietal surfaces until the adhesions are freed. During the progress of this manœuvre the sensitiveness of the pleura asserts itself, and the partially anæsthetized patient begins to cough with each

sweep of the finger over its surface. With each forced expiration, expansion in the lung is seen to take place, until when the adhesions are fully broken up the lung with its pleural covering will entirely fill the pleural cavity and even press outward through the operative wound. This is undoubtedly due to the healthy lung forcing a larger amount of air into the main bronchus than can escape through the partially closed glottis in the effort at coughing, so that the excess passes over into the bronchus of the collapsed side. In this way the healthy lung is used as an air pump to expand the collapsed one.

Some years after I had demonstrated this fact, Dr. A. H. Smith, of this city, told me that he had experimentally proven the same thing. He demonstrated it by taking two pairs of bellows to which he attached rubber tubes which were carried upward into a " Y," and this was in turn attached to a larger tube on which he placed a spring. If one pair of bellows was then emptied, air could be pumped from the other and escape without having any effect on the empty pair, so long as the lumen of the larger tube was of sufficient size to allow of the egress of the full amount of air. As soon, however, as the spring on the larger tube was allowed to compress it, so that the full bellows-full of air could not escape at each compression, the air immediately flowed back and expanded the collapsed pair of bellows.

If the lung, instead of being in the apex, is compressed against the side and attached to the diaphragm, I have found it advisable to loosen the diaphragmatic adhesions first. These are usually much heavier and more difficult to separate than those in the upper part of the cavity. Care must also be exercised to recognize the margin of the lung and the curve of the diaphragm, both of which are sometimes very difficult to do. As soon as the separation of the diaphragm is complete, the other adhesions, as a rule, can easily be broken up by the finger, care being taken, however, if the empyema is on the left side, when one reaches that part of the operation where the pleura lies over the pericardium. Here the operator feels each contraction of the heart, and can tell at once exactly how much

pressure he can use in separating this portion of the lung. As a matter of fact, I have never had any difficulty during this part of the operation. It does not seem to cause any disturbance of the heart, and does not offer any greater difficulties in the separation of the adhesions than any other part of the cavity.

As far as possible, the operator should try to keep in contact with the parietal pleura during the separation of the adhesions, to obviate the possibility of tearing the lung. Sometimes it is impossible to avoid tearing off the pleura over a circumscribed area, and I have not infrequently produced a pneumothorax during the operation. This, however, no longer causes me any anxiety, as the healing process soon closes the opening in the lung; and, as a matter of fact, I have been successful in closing several cases of pyopneumothorax and getting a complete cure by this method of operating.

One of the difficulties that caused me a great deal of worry in the beginning, was the fear of tearing into the lung and having a severe hæmorrhage. I have, however, never had any difficulty of this kind in any of my cases where it was not possible to control the hæmorrhage very readily. In case of opening a vessel in some portion of the lung that is not directly under the field of observation, the operator should at once have the anæsthetist put back his anæsthetic and bring the patient under complete narcosis. The lung will then again collapse and the bleeding will either stop from this alone, or it can be found and controlled either by means of the Paquelin cautery or any other measure that may seem advisable. We have found that it is an aid in these cases to wash out the pleural cavity, sometimes two or three times during the course of the separation of the adhesions, in order to get rid of the blood clot that results from the oozing from the denuded surfaces, and to get rid also of the coagulated lymph that is set free during the course of the manipulation. This is always done by having hot saline poured into the wound from a pitcher—never from a metal douche or an irrigating bottle. In this way there is no increase in hydrostatic pressure, and the fluid poured in is washed around by the expanding lung and flows

out again through the free opening at each expansion. As soon as the lung is fully expanded, a drainage tube is inserted, the skin wound closed around the tube, and a voluminous dressing applied.

We found in the course of our work that it is impossible in these cases to use a drainage tube of the old type. It almost invariably—by its rubbing against the pleura of the expanded lung—kept up a constant pleuritic cough, another illustration of the fact that the pleura is not insensitive in these cases. Dr. H. D. Furniss, formerly house surgeon of the New York Post-

FIG. 1.—Drainage tube.

Graduate Hospital, while on the staff devised a tube to obviate this difficulty. This is simply a piece of rubber tubing with a flat piece of rubber on either end, made in different lengths to fit different thicknesses of chest wall. In appearance it is very similar to a spool. The smaller flange of this tube rests against the inner wall of the chest, while the outer and larger flange rests upon the skin and prevents the drainage tube from falling into the pleural cavity.

The after treatment of these cases is conducted in the same way that is usual in other cases of empyema. A spirometer is useful in keeping up the full expansion of the lung, and with children the small rubber toys made to blow up help materially with the subsequent pulmonary gymnastics.

I have now operated on 225 cases by this method. Only those cases where the history was complete have been included in these statistics. Of these, 97 were cured and 58 were improved. Of the 58 improved cases, 40 were referred to the dispensary for dressing, and the great majority of them were completely cured; 9 were sent to the summer home; 9 were transferred to the Health Department hospitals. One of these

died some time after being taken home; the particulars are not known. Seven cases have been operated upon a second time, and in these it is surprising to find how thoroughly the lung has remained in full expansion. In one, an adult, operated upon some years ago for a very extensive empyema, a second operation was necessary because he lost his drainage tube into his pleural cavity. In order to reach these tubes it was necessary to separate the adhesions on each side of the sinus where they had been lying, the pulmonary and the parietal pleuræ being in contact everywhere excepting at the point where the tubes had rested.

There have been 47 deaths, or 20 per cent. This, of course, includes the deaths from all causes and for all periods of time after operation. The causes of death were:

Nephritis, suppression of urine, and turpentine poisoning	1
Nephritis alone	1
Tuberculosis	3
Pyæmia, 19 days	2
Enteritis and pneumonia	1
Attack of vomiting 3 weeks after operation	1
Pneumonia, both sides	2
Collapse on opening chest	1
Diphtheria	3
Volvulus	1
Empyæma and abscess of lung	8
Shock	8
Exhaustion, from 2 to 42 days	22

If we take into account the cases dying within one week of the operation, as due to the effects of the operation itself, we get 15 cases. The others in the above list, in all probability would have died under any method of operation.

The length of time the patients have remained in the hospital, has varied from 6 to 42 days, an average of 29 days.

In children under 18 months of age the mortality is very much higher than in older patients.

The shock following this operation is distinctly less than in the other operations for chronic empyæma. Within two or three days the patients are able to sit up, and they are usually out of bed within a week.

CYSTS OF THE OMENTUM.

BY RUFUS E. FORT, M.D.,

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A female child, two and a half years old, was presented February 21, 1906. She was fairly well nourished and gave history of no illness except two attacks of acute indigestion, each lasting several days. Abdominal enlargement was noticed eighteen months before by her mother. This had progressed until child now had an abdominal circumference of twenty-eight inches at the umbilicus. General health and nourishment had been very good, with no symptoms referable to the abdominal condition, except some dyspnœa upon exercise.

Examination revealed the following physical signs, great abdominal distention, abdominal veins prominent, complete dulness upon percussion over entire abdomen. Not a resonant note could be found anywhere. Fluctuation and a decided thrill wave could be elicited at any portion of the abdomen. Pulse 100°, temperature and urine normal.

The enormous abdominal distention led me to the conclusion that gradual relief of the hydrostatic pressure upon the splanchnic vessels offered the safer course. Consequently, on February 23, five pints of dark bloody fluid were removed by aspiration. In five days examination showed some decrease in the size of the abdomen from the time of the aspiration.

The abdomen was opened through a median incision, extending from above the umbilicus upward. There presented at once a dark glistening tumor, having the appearance of a distended gangrenous intestine, which, owing to its flaccid condition, was delivered through the incision without rupture. It was found to be a collection of fluid in the folds of the great omentum, extending from under the pylorus on the right along the greater curvature of stomach, to and including the folds of the gastro-splenic omentum. A chain ligature of catgut was applied from right to left, including the omentum and the gastro-splenic ligament. There were no adhesions, so the work was rapidly

accomplished. The abdomen was closed. Recovery was uncomplicated and the child left the hospital well in two weeks.

Closer observation of the specimen shows the absence of a distinct capsule, the fluid being between the folds of the omentum. There was an absence of fat in the omentum but the vascularity of the omental wall, as would be expected, was great, Closer inspection showed the stab of the aspirator five days before had not closed but continued to leak, this accounting for the decrease in the abdominal measurements, from day of aspiration to the day of operation. There was, however, no free fluid in the peritoneal cavity, the absorption having been quite in proportion to the leakage.

The fluid had a specific gravity of 1,007 and contained albumin and many degenerated blood cells.

In reviewing this subject we find it first described by Gairdeur [1] in 1851. Subsequently I have collected twenty-one cases. The case which I have reported, so far as my investigations have gone, will make the twenty-second case.

The three points which have impressed me most are: First, the impossibility of diagnosis without exploration; second, the condition is seen most often in children under ten years, 50 per cent. under ten—65 per cent. under twenty, which leads us to the belief that it is of congenital origin; and third, it occurs more frequently in females, 75 per cent.

Jacobi [2] states that perhaps all of these tumors are of lymphatic origin and result either from dilatation of the lymph vessels or from cystic degeneration of the lymph nodes. He submits this as Rockitansky's idea, however, and offers no further evidence. The histologic characteristics of their encapsulation and the contents of these cysts, however, are of such a variety, that it is hard to believe that a distinct etiologic factor can be arrived at. Lymph, chyle, serum, both with and without blood cells, have all been reported. Two dermoid cysts have also been reported, Waldy [3] and Spencer Wells [4] reporting such cases.

The presence of a distinct capsule within the folds of the great omentum has been observed, but in a majority of cases,

we find the tumor separating the folds of the great omentum with no other encapsulation. Again we find the tumor with a distinct capsule, not within, but attached to the omentum by thin ribbon-like bands. This leads Phillips [5] to suggest that they find their origin in the ovary, subsequently becoming detached by twisting of the pedicle, and continuing life by attaching itself to the omentum. The same question presents itself to Jessett,[6] but he admits his position is not tenable, by stating that the large vessels passing around the entire cyst came direct from the omental vessels.

Jacobi [7] believes that it will always be a question whether the hyatid omental cyst originates in the liver or in the omentum.

Marsh and Monserrat [8] report a case of a child, less than two years old, with a large cyst with a distinct capsule showing externally an endothelial covering and covered internally by a coat of fine connective tissue with numerous blood channels, the connective tissue coat being represented by a marked layer of fibrous tissue. There was great vascularity of the cyst wall, which he suggests as being evidence of the traumatic or inflammatory origin of the condition; but this case had been repeatedly aspirated, and I assume that trauma and local peritonitis from aspiration could have produced the same condition.

The case reported by Hearne [9] furnishes the most convincing proof of the congenital origin of these neoplasms. This was a case of a boy, age eight, in which he obtained a distinct history of a fluctuating tumor at birth, which decreased in size for some time, after which distention became apparent. It was aspirated at the age of four but refilled and was removed four years later by Hearne.

Cotman [10] reports a most interesting case of a young lady, age twenty-one, who received an injury by being thrown violently against the shaft of a cart, upon whom he operated three months later. The omentum was curled up under the posterior portion of the greater curvature of the stomach with a cyst connecting with a perforating wound of the posterior portion of its pyloric end.

This is the only case reported which has a distinct history of trauma, and the symptomatology in this case is also unlike the remaining cases. There were repeated attacks of collapse, vomiting, continued pain, and altogether a clinical picture much graver than we find in the other reports.

The youngest reported case is the one reported by Schramm,[11] a child one year old. This patient's abdomen measured thirty and one-half inches in circumference. A dark grumous fluid was within the folds of the great omentum.

A case reported by Young,[12] of London, in physical characteristics, is identical with the case which I have just reported.

Symptomatology.—It is rare that these tumors are discovered in earlier stages of their development. Pain is not usually an accompaniment, and when it is present it is not severe in character, and is usually attributable to digestive disturbances, though several observers have noticed that the radiation of pain was usually toward the liver. It has also been observed that during pain there are marked digestive symptoms. Anorexia, dyspepsia, vomiting, diarrhœa, alternating with constipation and even cachexia.

The costal type of respiration and severe dyspnœa have also been observed. Hahn states that the special symptoms of tumor of the omentum present an extraordinary analogy to those of movable kidney. I can see that this may be true in those cases in which we have a disturbing symptomatology, but in the case of my own, as well as in others, there was an absence of subjective symptoms sufficient to point to any diagnosis. It is evident, therefore, that omental tumors present no characteristic symptoms, and the clinical picture is that which accompanies all other forms of cystic abdominal growths.

This is emphasized by the fact that the omentum possesses no physiologic function other than a covering membrane. Therefore, it is most natural that small tumors will produce no symptomatology, and that symptoms will only be produced when the weight of the tumor produces dragging or when pressure symptoms occur.

Diagnosis.—No case has yet been reported in which the

diagnosis has been positively and accurately made. The condition has been diagnosed as ascites, lipoma, aortic aneurism, hydatic cyst of the liver, pancreatic cyst, cyst of the urachus, tubercular and encysted peritonitis.

Pean mentions three points as pathognomic of omental tumor. First, superficial location, second, abnormal passive mobility with downward limitations, and third, absence of functional disturbance, to which Anganeur adds that respiration has little or no affect on the position of the tumor, and Witzel has noticed movement of the tumor with intestinal peristalsis.

I conceive that in the earlier stages of this condition, where there has been an absence of an inflammatory process, consequently an absence of adhesions to the adjacent viscera, that these points may be of diagnostic value, but the rare occasions on which we will see these tumors in this stage, I fear, give but little practical value to their suggestions. This is proven by the fact that Pean, as well as others, have failed to make the diagnosis.

Palpation.—Palpation reveals an elastic growth with fluctuation. The thrill wave is present and dulness is absolute over entire tumor on percussion. This shows its cystic nature and that it is anterior to the hollow viscera. Lipoma is the only solid tumor with which it may be confounded, fluctuation having been elicited in this condition.

Differential Diagnosis.—The superficial location may simulate neoplasm of the abdominal wall, lipoma, though lipoma is usually fixed. It occurs almost always in adolescence and there is an absence of pressure symptoms.

Pancreatic tumors are usually malignant, productive of constant pain, usually produce icterus, fatty stools, and rarely occur before middle life, and, as a rule, coils of the intestine yielding a tympanic note may be found over the tumor. Cyst of the urachus, though rarer than omental cyst, if seen early, its origin may be observed to be lower and its mobility is less marked and the same in all directions.

In cyst of the mesentery we usually have a coil of intes-

tine anterior. Ovarian cyst in their earlier stages may be differentiated by pelvic examination and by the physical signs, showing that the tumor springs from the lower zone of the abdomen.

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TUBERCULOSIS OF THE BLADDER.

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(Continued from page 283.)

PART II.

DIFFERENTIAL DIAGNOSIS.

The symptom complex, progressive increase of frequency and pain in micturition, pus and tubercle bacilli in the urine with occasional blood at the end of urination, occurring in a patient, in the absence of any other definite cause, is strongly suggestive of tuberculosis of the bladder. All of these symptoms, however, may be met with in the absence of any bladder lesions, in tuberculosis of the kidney or of the prostate. Hunner cites several instances of tuberculosis of the kidney which presented only bladder symptoms, whereas cystoscopic examination proved the bladder to be free. The only positive sign, is the appearance of the mucous membrane as seen by cystoscopic examination or through an artificial opening.

Bladder tuberculosis is to be distinguished from tuberculosis of the kidney, tuberculosis of the prostate, simple ulcer, various types of pyogenic ulcerations, pyogenic cystitis and new growths.

Over and over again *tuberculosis of the kidney* has been mistaken for disease of the bladder, for the reason that the kidney process very often in the early stages shows itself mainly or entirely through bladder symptoms—frequent or painful micturition, etc. This distress is induced reflexly from the kidney, or by irritation of the urine, and is not due to lesions of the bladder mucosa. A careful inquiry into the history will usually bring to light the fact that the patient has suffered at some time from pain, or other sensations referable to the affected kidney; and a careful palpation of the renal region will generally show physical signs, enlargement, rigidity of the

muscles and tenderness. Frequent and painful micturition, accompanied by blood at the end of the act is very strongly suggestive of bladder implication, but the only positive information is to be obtained by cystoscopic examination.

In *tuberculosis of the prostate* with extension to the posterior urethra, there is much local discomfort and great bladder tenesmus. In such a picture we have three considerations to help us; first, rectal examination may point to implication of the prostate, but does not exclude the bladder; secondly, the first specimen of urine voided may be comparatively free from pus, while the last is very cloudy; this, however, is suggestive of implication only of the prostate, without disease of the bladder.

Simple ulcer of the bladder is a well-known but an infrequent condition. When the lesion is situated near the trigone, many of the distressing local symptoms of bladder tuberculosis are produced. Here we must rely on the absence of tubercle bacilli from the urine, the absence of tuberculosis elsewhere in the body, and the difference in the cystoscopic picture. A simple ulcer as seen through the cystoscope is usually circular, the edges are fairly smooth and regular and are not undermined, the base shows a red and firm granulation tissue, and the surrounding mucosa presents no evidence of tubercles.

In ulcerations due to the various forms of cystitis, the appearance is very different from that of tuberculosis. The inflammation of the mucosa is very much more extensive; the ulceration is more superficial and occurs as small areas scattered here and there over the inflamed mucous membrane. There are no tubercle bacilli in the urine, and the other organs are free.

Stone has occasionally preceded the development of tuberculosis and has very frequently complicated it; in such instances it is of course impossible to arrive at a differentiation by means of the ordinary objective symptoms. As a rule a calculus does not produce the extremely distressing, frequent, and painful micturition that belongs to tuberculosis; the frequency is less at night, is alleviated by rest and exaggerated

by exercise. All doubtful cases should be examined through the cystoscope.

Acute pyogenic cystitis presents a symptom-complex similar to that of tuberculosis, but should never be mistaken for it; for the one is relieved in a short time, while the other persists. Chronic pyogenic cystitis never gives rise to symptoms of such an intense degree as does the tuberculous inflammation.

Papilloma occasions less bladder disturbance, causes less pus in the urine, and produces more profuse and more continuous bleeding.

Carcinoma is seen in older patients and is not attended by the same distressing symptoms until a later stage, when a diagnosis can be made from other signs.

MEANS OF DIAGNOSIS—*Cystoscopy.*—When it is considered how little can be done for such a tuberculosis, even after a diagnosis is made, and when it is realized that a slight trauma may prove a source of danger by allowing an infection to occur, or by furthering the extension of one already present, the advisability of the introduction of a cystoscope seems questionable. But, on the other hand, when the need of finding out the exact state of the kidneys, and of determining the presence and extent of disease in the bladder so as to more clearly settle the question of operation is fully appreciated, all objections are removed.

Cystoscopic examination, owing to the diminished capacity and the extreme irritability of the bladder, is often unsatisfactory and occasionally impossible, but a patient and a careful trial will in most instances be amply rewarded. The method which I employ is as follows: When possible the patient is given 1 gramme of cystogen every three hours for 12 hours before the examination and directed to drink an increased amount of water. When the bladder is very irritable, a hypodermic injection of ¼ gr. of morphin is administered half an hour before the introduction of the cystoscope. The genitalia are cleansed with warm water and soap and washed with a 1–1000 bichloride solution; the urethra is irrigated with 500 cc. of sterilized salt solution; the penis is then wrapped

with a sterile piece of gauze, the glans not being covered. One ounce of a 4 per cent. solution of cocaine is then injected into the urethra by means of a blunt-pointed syringe (the cocaine solution must not be sterilized, but the crystals are put in a sterile bottle and dissolved in sterile water); this is retained for 5 minutes, the meatus being grasped with two fingers. Such an amount of cocaine would seem to be large, but I have no hesitancy in injecting even more, provided there are no recent abrasions of the mucous membrane which have been made by the introduction of instruments. Next, a previously boiled silk catheter with a prostatic curve, lubricated with sterile glycerine, is introduced into the bladder, and the organ very carefully washed out by injecting and immediately allowing to flow out 20 to 30 cc. of sterilized water. These washings are repeated until the liquid returns clear. One hundred and fifty cc. of sterile water are then injected into the bladder, provided it will tolerate that quantity; if not, the viscus is filled to its capacity. If less than 100 cc. is all that can be retained, the examination is not satisfactory, and if less than 60 cc., nothing definite can be seen.

In obstinate cases which will not tolerate sufficient fluid, I first inject 1 oz. of a 4 per cent. cocaine solution and then fill the bladder with a 2 per cent. solution. In this way I have been able to inject sufficient fluid to give a fairly satisfactory inspection. Where there is any bleeding I use from ½ to 1 oz., of a 1–2000 solution of adrenalin.

Tubercle Bacilli.—The method which I have lately employed for the detection of tuberculous organisms is as follows:

Procure if possible a catheterized specimen; if this is done with ordinary precaution, we can be reasonably sure of avoiding contamination with smegma bacilli. When the use of the catheter is not feasible, I thoroughly cleanse the gland with soap and water and then wash it with a 1–1000 bichloride solution. The patient is then directed to urinate and the first half of the urine is thrown away; the second half is caught in a sterile conical glass and put aside for four hours to settle; the supernatant fluid is poured off and the remainder centrifu-

galized. In females, in order to avoid contamination by smegma bacilli, it is always necessary to use the catheter, for it is much harder to cleanse the urethral orifice thoroughly than in the male. Young and Churchman have found that by thoroughly irrigating the anterior urethra in males before urination smegma bacilli are entirely eliminated. After the urine has been thus prepared the sediment is taken out with a clean pipette and one drop put on each of 4 slides; these slides are then adjusted on an iron ring some distance above a Bunsen burner, care being taken to have them high enough to prevent too intense a heating, and are allowed to remain until the fluid has evaporated and they have become perfectly dry; they are then passed lightly through the flame, placed again on the ring, and the smears are well covered with carbolfuchsin solution. The flame then is passed backward and forward under them, so that they become hot enough to give off vapor, but not sufficiently so to boil; this heating is kept up for four minutes, fresh fuchsin is added from time to time, and the specimens are carefully watched to prevent evaporation; they are then removed, washed lightly in running water, and immersed in Gabbet's methylene blue, where they remain until all of the red color has disappeared. There is no danger of decolorizing the tubercle bacilli, if they have been well stained with the red. The usual instruction, of applying the Gabbet's solution for from one-half to one minute, I disregard entirely, and am governed only by the disappearance of the red color. The specimens are then washed again, the excess of water is removed with blotting paper and ordinary xylol poured on and allowed to remain for two or three minutes; after this immersion oil is quickly applied before the specimen has had time to dry.

In the examination I use a mechanical stage, and go over the whole field in four or five slides. If these precautions are carried out, tubercle bacilli will be found in every instance of bladder tuberculosis.

For directions, in case it becomes necessary to differentiate between smegma bacilli and tubercle bacilli, I refer the reader

to my former paper on renal tuberculosis. Several observers have stated that smegma bacilli are somewhat broader than tubercle bacilli, are arranged in smaller clumps, and scattered more evenly and more numerously throughout the field, whereas the others are more slender and are seen in crescent-shaped masses. In ammoniacal urine the tubercle bacilli take the stain with some difficulty and are more readily decolorized; in some instances they cannot be stained, but this is very exceptional.

Tuberculin.—The use of tuberculin is a moot question. Two cases have been reported in which it rendered a latent bladder tuberculosis active; another, in which it increased the progress of a renal tuberculosis. Morelle cites an instance in which an intractable tuberculous cystitis was lighted up, after an injection of tuberculin given to determine the presence or absence of disease in the lungs. Baümler records a case of tuberculosis of the kidney and bladder which were made very much worse by its use. Roux saw incontinence of urine, hemiplegia, and aphasia develop after two injections for a tuberculosis of the prostate.

Many experimental injections into animals have proved that the toxin has a baneful effect on the kidney epithelium. On the other hand, there are numerous eminently qualified and careful clinicians who assert that it has no injurious effect, and T. Warren Brown and Schröder have reported two cases in which its use seemed to be beneficial.

Wright and Douglas have proved that tuberculin T. R. in sufficiently large doses to produce a decided reaction is harmful. I think, therefore, that this work stands as evidence against its use for diagnostic purposes.

In consideration of these possibilities, and knowing that it is comparatively easy to make a diagnosis by other means, I do not think that tuberculin should ever be given.

Cryoscopy.—The determination of the freezing point and the molecular concentration is of no service in tuberculosis of the bladder. The same may be said of the administration of phloridzin, methylene blue and other drugs.

PROGNOSIS.

A few, but very few, cases of tuberculosis of the bladder heal; a minority run a chronic course, extending over a number of years; but in the majority the progress is more or less rapid and the downward course is marked by few interruptions. The symptoms tend to increase in severity and the terminal months are attended by an extreme suffering which is hardly equalled in any other disease. The process is prone to destroy the bladder and to spread to other organs. The average duration of life, after the disease has become established, is somewhere in the neighborhood of 35.05 months.

It is certain that the disease may heal either spontaneously, or as a result of surgical or hygienic treatment. Personally I have not seen such an instance, but the character of the observers places their statements beyond doubt. Haenens watched a tuberculous ulcer for 2 years, and noted its final healing; Stoeckel in a careful study with a cystoscope has seen both tubercles and tuberculous ulcers clear up; Cumston, Strauss, Motz, Hallé, and Battle have observed similar results. These records, together with a number of others, in which are noted the disappearance of bladder lesions after nephrectomy, prove beyond doubt that it can occur. In my collected series of 416 cases, there were 29 cases reported as cured; I have excluded as far as possible the doubtful ones, but I have been compelled to include some others about whose nature I was not thoroughly convinced.

But surgical and medical measures applied directly to the bladder (except the complete removal of the focus) have in the majority of instances no effect; indeed in not a few they are harmful; the disease, in spite of, or by the aid of, these interferences, tends progressively downward, and the patient finally succumbs to general tuberculosis, or is worn out by the frequent and painful micturition. Hygienic treatment—change of climate with proper care and appropriate food—offers by far the best chance for recovery.

So far as the bladder condition itself is concerned the

ulcer usually confines itself to the mucous coat, but occasionally it perforates the bladder wall. The disease process inclines very early to extend from the bladder to the prostate and vesicles, but only very exceptionally does it ascend to the kidneys. Formerly an ascension was thought to be very common, but now it is known to be extremely rare; in order that it may occur, there must be some underlying pathological condition, which allows the tuberculous urine to regurgitate along the ureter, and remain in prolonged contact with the mucosa of the pelvis. Lewin and Goldschmidt have concluded, from experiments on rabbits, that a certain regurgitation happens during contraction of the bladder when the viscus is about half filled. These experiments have not been confirmed by others, but even if such a regurgitation does sometimes take place, the urine quickly returns into the bladder.

The tendency of bladder tuberculosis to spread and form general miliary tuberculosis, cannot be definitely estimated, but does not seem to be great.

TREATMENT.

A study of those cases of tuberculosis of the bladder which I have seen, and a careful analysis of the reported instances, force me to the conclusion that, with the exception of hygienic treatment and the complete removal of the focus, there is very little to be done for this malady. Drugs have no good effect, and other direct surgical treatment seems to do little good and frequently much harm. Nevertheless, it may be as well to pass in review the various medical, hygienic and surgical measures that have been recommended.

Medical Treatment.—The agents which are recommended for internal use are guiacol, iodoform, cod-liver oil, arsenic, icthyol, and not a few others. There is very little evidence to prove that these have any effect on tuberculosis of the bladder, and personally I believe that they are all useless. Diuretics and urinary antiseptics, such as urotropin and salol, may mitigate secondary infections, but on tubercle bacilli they have no influence. The cases which have been reported as cured by medical treatment would probably have recovered without

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it; the medicine, so far as the cure was concerned, was more co-incidental than causative.

Tuberculin.—This agent has been used in numerous instances, in most of them without benefit; two patients, however, the synopses of whose cases are given below, showed decided improvement: T. Warren Brown reports the case of a female of 16, who had undoubted tuberculosis of the bladder as evidenced by the presence of tubercle bacilli in the urine and tuberculous lesions in the bladder. After three months' use of Koch's T. R., there was decided alleviation of the symptoms, and the ulcers in the bladder had undergone retrograde changes. The second case, recorded by Schröder, was that of a female, aged 39, who suffered from great vesical distress, had tubercle bacilli in the urine, and characteristic ulcers in the bladder. Tuberculin T. R. was used for five months; the patient improved very much and gained in weight, but later she had a recurrence.

The very recent and extremely suggestive work of Wright and Douglas on the control of the administration of tuberculin T. R. by using the tuberculo-opsonic index may prove of great value, but as yet the method had not been sufficiently used to determine its clinical value, although the improvement which has been noted by Wright in some cases of tuberculosis of the bladder appears very promising.

Pardoe has used tuberculin in very minute doses, not sufficiently large to produce any reaction. He agrees with Wright and Douglas that the reactive doses are harmful. He has treated several cases of bladder tuberculosis with marked benefit. A few patients, he states, were practically cured.

Hygienic Treatment.—A suitable climate, plenty of good air and sunshine, combined with good food, go farther toward combating bladder tuberculosis than any other agents at our command. The same climates that are of use in pulmonary tuberculosis are equally serviceable in this form of the disease. I usually recommend patients with means to go to the Adirondacks for about two years; others, who are obliged to earn a livelihood, I send to Colorado, California or New Mexico.

The recent observations of Halsted on the beneficial effects of out-door life on joint and other forms of surgical tuberculosis are very encouraging and give us reason to hope that many cases of genito-urinary tuberculosis will be similarly benefited.

As much well selected food as the patient's digestion can stand should be given, eggs and beef forming the base. Milk, which is so valuable in kidney and bladder diseases and which forms a large part of the diet in pulmonary tuberculosis, should be taken in bladder tuberculosis more sparingly, for the imbibition of fluid necessitates more frequent urination and consequently more bladder irritation. In general, then, sufficient liquids to carry on the proper body metabolism should be allowed, but more than this may prove injurious.

Surgical Treatment.—Suprapubic opening of the bladder, combined with curetting, cauterization, or excision; complete removal of the bladder, perineal section; curetting and cauterization through the urethra in the female; cauterization through the urethra in the male; artificial vesico-vaginal fistulæ; irrigations and instillations; removal of the primary focus (nephrectomy, nephrotomy, castration, prostatectomy, and prostatomy); and resection of the nerves for relief of pain, are the measures which have been proposed to combat bladder tuberculosis.

Suprapubic Cystostomy.—The first suprapubic opening for tuberculosis of the bladder was done by Guyon in 1885; three years later Poncet after doing a cystotomy sutured the bladder wall to the abdominal wall in order to prevent healing. The technique of this operation is difficult, for the reason that the bladder by its contraction is drawn well down into the pelvis and can be only slightly distended. To partly overcome this hindrance and force the bladder toward the suprapubic region, Peterson devised a rubber bag which is placed in the rectum and distended. This apparatus is a valuable adjunct, but it should be used with care since two ruptures of the rectum have been recorded after its use.

The uses of the suprapubic opening are: First, to drain

the bladder and relieve the distressing symptoms; second, to allow of the use of measures against the disease process, excision, curetting, cauterization (by heat or chemicals), the application of remedies (such as iodoform) which are thought to be anti-tuberculous.

A cystostomy for the relief of symptoms is usually employed in the late stages when the patient is being worn and harassed by frequent and painful micturition; in such a state a suprapubic opening is most urgently demanded and is followed by immense relief, but that the opening and drainage have any distinctly beneficial effect on the disease is doubtful. A great many cases have been reported as improved, but it is probable that the beneficient influence was induced by the relief of symptoms rather than by the betterment of the actual disease.

Secondly, to attack the disease. When we study tuberculosis of the bladder by cystoscopic examination, or by observation after death, we find that, while gross lesions appear to be more or less circumscribed and superficial, careful inspection shows that in the large majority of cases the process is widely scattered over the mucous membrane and that the ulceration is often deep. Looking these facts squarely in the face, and realizing their full significance, the utility of trying to remove the diseased area would seem very questionable. What is really done in most cases, when this is attempted by curetting, is simply a partial scraping of the ulceration and a consequent wounding of the surrounding mucous membrane, with the possible scattering of the disease in the abrasions so made. This has been proved by a number of observations in which tuberculous granulations have sprung up extensively just after the operation. In order to study this subject more fully we will take it up in detail.

Excision of the Mucous Membrane.—I have records of this procedure 13 times; twice with complete removal of the whole mucous membrane of the bladder (Brohl and Bardenhauer) and three times with the resection of the portion of the bladder wall. Ten of the cases were followed by death

at varying intervals; one was not improved (Greiwer); two were improved (Greiwer, Matile). Brohl's and Bardenhauer's patients died some time afterwards. Young removed a section of the bladder in a case of tuberculosis of the seminal vesicles; the patient lived for a few months and died from general tuberculosis. Cushing excised a part of the bladder carrying a tuberculous ulcer; the patient developed cerebral complications, probably emboli, and died in a few days. Kelly in a number of instances has taken out a section of the bladder in conjunction with a nephrectomy; the immediate results in the majority were good; the ultimate reports I have not obtained. Delagenière excised all of the mucous membrane of the trigone and several areas from the bladder wall; the patient rapidly died of tuberculosis of the lungs. The results, therefore, of excision are not encouraging; in the twelve collected cases there were no cures and only two improvements.

The Paquelin Cautery.—Cauterization by heat was first practised by Guyon, since which time it has been frequently repeated; it has the advantage over curetting that it does not wound the surrounding mucous membrane, and that it does not scatter the disease; but it must be remembered that there is a very marked reaction from the burning, and that there is a large enough slough to be thrown off, which produces a lowered resistance and invites extension.

Cauterization by Chemicals.—Chloride of zinc, carbolic acid or nitrate of silver, may be of some utility; but when we consider that their action is at best superficial, that they do not penetrate deeply, and that they are followed by the production of necrotic tissue which entails sloughing and its consequences, we see that their use is not without certain disadvantages.

Iodoform Applications.—Iodoform possibly has some anti-tuberculosis effect, but has not fulfilled the promise which it gave at first. Guyon believes that it does not influence the growth of tubercle bacilli, but that it neutralizes their toxins. Nothing has been brought forward in the way of experiment to prove this point.

Results of Suprapubic Cystostomy.—In 119 suprapubic cystostomies there were 9 cases reported as cured, 48 as improved; 34 cases were reported as not improved, 27 as showing late deaths, and 1 operative death. The wounds were kept open for variable periods. Powers records one in which the bladder was drained for five years and the patient regained his former health. Bandler in a female kept the sinus open for three years, and the patient remained moderately well. In a number, a second operation was performed to close the fistula; there are eight recorded instances in which it remained open in spite of these efforts.

Desnos did a suprapubic cystostomy with complete excision of the diseased area; five weeks later the fistula showed tuberculous granulations and the bladder was nearly filled with them; the patient succumbed in 8 months. The same author has observed two other analogous cases. Matile reports a case in which the fistula closed and then broke down with granulations apparently tuberculous. Johnson did a suprapubic cystostomy and made a vesico-vaginal fistula; the suprapubic wound was allowed to heal and the vaginal wound kept open; the patient's health was completely restored. A Johns Hopkins Hospital patient, upon whom a suprapubic cystostomy was done, was wearing a drainage apparatus at the end of three years and reported very little local discomfort and good general health. Scherb in 12 suprapubic cystostomies with curetting had only one good result; some of the other patients improved, but only temporarily.

Loumeau reports 12 suprapubic cystostomies; 3 of the patients were cured, 8 were improved, and 1 died. These are included in the above statistics, but I am constrained to have some doubt about them for the reason that the percentage of cures is so high. In striking contrast with this are the results from Guyon's clinic as reported by Banzet; there were 13 suprapubic cystotomies; 7 of the patients died soon afterwards, 3 were not improved and had to submit to other operations, 5 obtained a passing benefit and 1 was very much improved; this last case is placed in my cured list, for it was

stated in a report made by Guyon that the patient was practically well.

Personal observation of the cases in my private practice and those which I have seen in hospitals, together with a study of the literature, convinces me that a suprapubic cystotomy should be done principally for the relief of symptoms, and rarely with the idea of removing the tuberculous area. It may be urged that in the above list the number of improved cases and the cured ones do not justify such an assertion. To this it can be answered that the cured instances of undoubted tuberculosis of the bladder are very few, fewer even than my statistics might indicate, for I have included some reports which to me were doubtful. In regard to the list of betterments, a following up of the patients will show that the amelioration is brought about usually by the immediate and great relief from the terribly distressing, painful, and frequent micturition; this riddance allows the patient to sleep and eat and become, therefore, generally better, but I submit that the disease in the large majority continues to progress.

Perineal Section.—Philip in 1803 did the first perineal section for the relief of painful cystitis. He was followed in 1806 by Blizzard and Guthrie. Thompson some time later improved the technique of the operation and brought it more into popular favor; several years afterwards it was further modified by Guyon. The first section of this kind for tuberculosis of the bladder was done in 1885 by Boursier.

In a collection of 26 perineal sections in my list 10 of the patients died, 1 was nearly cured, 5 were improved, 2 were unimproved, 2 were made worse; in 6 cases no results were given. In the 10 deaths, there were 2 patients who died from the effects of the operation—probably from peritonitis (Deltheil and Clado). While only two cases were reported to have been made worse, from the description of the patients after the operation, it is to be supposed that there was a larger number. Tédenat reports an instance in which miliary tuberculosis followed perineal section. Bryson had one case in which the wound filled with tuberculous granulations, and later ulcera-

tion into the rectum occurred. There were a number of others in which the wound became tuberculous and the sinus failed to close. Guyon reports 7 perineal sections; 6 of the patients receiving some benefit, but none being cured.

If there is an extensive tuberculosis of the prostate (prostatic abscess, etc.) perineal section is indicated, but for simple drainage or treatment of a tuberculous bladder, it is questionable if it ever should be done. The principal objection to it is that it necessitates a deep wound and it exposes various tissues —prostate, urethra, muscles—to infection by tubercle bacilli. Unless for a definite reason, perineal section should never be the operation of choice.

Entire Removal of the Bladder.—This has been carried out twice for tuberculosis. Both patients died within a short time. It is needless to say that an operation of such magnitude should never be performed when it is impossible to remove all of the diseased foci. This being the case in tuberculosis of the bladder, such a procedure is little less than criminal.

Removal of the Primary Focus.—This, in my opinion, is the operation which offers the best results from surgical interference. It is certainly the most rational procedure, for we have seen that bladder tuberculosis is practically never primary, that the organ withstands the presence of tubercle bacilli for a long time, that it becomes infected only after its resistance has been lowered, and that it tends to heal when freed from the infecting focus. Removal of the focus includes the following:

Nephrectomy.—In 19 nephrectomies, there were 5 deaths and 9 cures; the results in 5 were not given. There were many other patients who showed improvement of the bladder after removal of the kidney. These were collected in a former list of cases of renal tuberculosis and are not included in the present bladder series. It may be stated, I think, without question, that a mild infection of the bladder will heal after and that a more extensive one will be benefited by a nephrectomy.

Nephrotomy.—In cases of tuberculosis of the bladder in which nephrotomy was done, there were 2 deaths, 2 patients

were improved, and 1 was possibly cured (the kidney also healing). As there are only a few instances of tuberculosis of the kidney which have been cured by nephrotomy, the percentage of bladder recoveries must be very small.

Prostatectomy.—Up to the present time there have been so few tuberculous prostates removed from patients who were suffering also with bladder tuberculosis, that the general influence of such removal on the morbid process in the bladder is not known. It has not been considered right heretofore to excise a diseased prostate when the bladder also was involved; I am not thoroughly convinced that such conservatism is wise and intend to discuss the question more fully in a forthcoming paper.

Prostatotomy.—This is usually an operation of necessity brought about by the presence of an abscess. There are some patients in whom the bladder was probably implicated, who experienced great alleviation of the symptoms and improvement in health after prostatotomy, but I have not been able to find any case with sufficiently clear bladder records to enable me to form conclusions as to the ultimate influence of the procedure. It would seem reasonably certain that simple incision of a prostatic tuberculosis would be beneficial only when all of the diseased tissue had broken down into a softened mass and could be evacuated.

Removal of the Seminal Vesicles.—These organs have been excised for tuberculosis more than 40 times, but in these instances there was no report as to the bladder implication.

The results of the operation, therefore, in so far as the bladder was concerned, cannot be given.

Removal of the Testicles.—As I have not thoroughly reviewed the literature on tuberculosis of the epididymes, and have seen only a few cases in which a double castration was done in patients who were suffering also from bladder tuberculosis, I cannot state with exactness the effect which such a procedure has on the bladder; but from a general review I believe that removal of both testicles, when they contain the primary foci, has a beneficient effect on disease of the bladder.

Vesico-Vaginal Fistula.—Emmet in 1861 was the first to make a vesico-vaginal fistula for tuberculosis of the bladder. This operation has been practised extensively, but mainly upon patients who demanded relief from painful and frequent micturition. According to the reports many patients improved, but none, so far as I could find, were cured. Johnson records a complete restoration of health while the fistula remained open, but presumably the symptoms returned when it closed. Kelly and Hunner have had a few excellent results from it, but lately they have not practised it so much as formerly. The good effects of this operation are due mainly to the relief of the distressing bladder symptoms; further than this it has no influence on the disease.

Curetting Through the Female Urethra.—There were 17 cases recorded; 10 of the patients were unimproved, 5 were improved, and 2 were cured.

Out of the 10 cases recorded by Banzet, in 8 there was great improvement; the pain became much less, in some cases completely disappearing, and micturition was not so frequent; 2 patients were not benefited. Camero in 14 cases had 5 patients who were permanently, 5 temporarily improved; in 4 cases the results are not given.

Cauterization with chemicals has been practised both with and without curetting. In this connection Wittzack recommended lactic acid; it was used at first extensively, but is now less and less employed. Nitrate of silver is not well borne and seems to aggravate rather than benefit the disease, although Stoeckel, Noble, and others have seen good results from its use. Chloride of zinc is the most popular.

Cauterization Through the Male Urethra.—This is accomplished by means of a cauterizing cystoscope. One such case has been reported by Schmidt in which a tuberculous ulcer was treated in this way; some improvement followed, but the later history is not given.

Resection of the Sensory Nerves.—This operation was proposed for the relief of very painful and obstinate cystitis. It was first done in 1896 by Simpson; two years later Rochet

brought it into more general notice. The procedure consists in finding and dividing the sensory nerves of the bladder which pass off from the third and fourth sacral trunks. If the whole nerve (third or fourth sacral) is divided, enervation of the tissues in the perineum and possibly the penis will result. The technique of the operation is very difficult, because the nerves are small, obscure, and deeply placed.

Instillations.—Bichloride of mercury and iodoform have been extensively used; guiacol, creosote, ichthyol, gemonol, and lactic acid have been occasionally employed.

Sublimate was first used in this manner by Jefsner in 1889; later it was recommended by Guyon, and has been used very widely by his students, in whose hands its use has met with considerable success; elsewhere, however, it has not received very enthusiastic praise. Casper has employed it quite extensively with benefit, and Kelly in the wards of the Johns Hopkins Hospital has had fairly good success from its use. The procedure is begun by injecting with a suitable syringe, once a week, 10 to 20 cc. of a 1 to 10,000 solution, and gradually increasing the strength up to 1 to 1,000. The quantity is slowly raised to 50 cc. Guyon instils from 15 to 20 drops of a 1 to 1,000 solution; Kelly injects 30 cc. of a 1 to 10,000 solution; Casper rarely employs a stronger than a 1 to 5,000 solution. The more powerful solutions produce considerable pain and tenesmus which often continues for one or two days.

In my collected series 18 patients were improved, 15 unimproved, 2 cured, and 3 made worse.

Guyon in 33 instillations reports 15 patients unimproved, 8 improved, 5 very greatly improved, and 2 or 4 cured (?). In Casper's hands, there were some cases which improved very decidedly, but none were cured. In one instance in a man of 37, the pain ceased, urination became less frequent and there was an increase in weight.

In consideration of the fact that the tuberculous process penetrates the mucosa, implicates the submucosa and occasionally the muscle, it seems that any agent such as sublimate which for any beneficial action is dependent merely upon its antiseptic

property—a property which is utilized only when it is brought into direct contact with tubercle bacilli—can have at best nothing more than a superficial effect. Moreover, it exerts a deleterious influence upon the bladder mucous membrane, lowering its resistance and favoring the spread of the disease. I think, therefore, that while sublimate does good in some well selected cases, in the majority its effects are baneful.

Iodoform, in 5 to 10 per cent. mixtures with olive oil, liquid vaseline or glycerine, has been very extensively employed; 10 to 15 cc. of one of these emulsions are injected from 1 to 3 times a week. This drug has a slightly anæsthetic effect, is very well borne, does not damage the mucosa, probably is slightly anti-tuberculous, and would seem to be the best agent for instillation. It has found much greater favor with the majority of surgeons than sublimate, and has the very great advantage of being in no way harmful.

In my series there were 23 patients improved, 7 not improved, 1 made worse and 1 cured.

Chaudeleux injected 10 per cent. iodoform in ether in doses of 3 cc. This produced great pain, intense burning and discomfort. The procedure is simply mentioned to be condemned. It is hard to imagine how a man with any surgical knowledge whatsoever could inject such a mixture into the bladder.

Guiacol has been used alone in oil, and in combination with iodoform, in strengths of from 1 per cent. to 3 per cent. It has a local anæsthetic effect and is well borne. There are a few cases reported as improved, but none as cured.

Gemenol in from 5 to 10 per cent. solutions in oil has been employed and recommended by Hain; 4 patients were improved and 2 were unimproved; none was cured; and none was made worse. The agent belongs to the turpentine series; it is decidedly antiseptic but is not irritating.

Lactic acid was first used by Wittzack, who injected 2 cc. of a 5 to 8 per cent. solution once a week. The reactions were very marked; the pain and frequency were much increased and the burning and discomfort exaggerated. Casper used this

remedy and later substituted lactate of cocaine for it. Both have now been abandoned.

Pyrogallic Acid.—Minet has had good results from the daily injections of 5 cc. of a 2 to 5 per cent, aqueous solution of this agent. Rovsing has also employed it with little benefit.

Formalin was recommended by Lamarque in the strength of 1 to 500; the amount of each injection is not given. Guyon employed this drug in 7 cases, but had no successes.

Creosote in weak solutions in oil was tried at the Necker Hospital in 3 cases of tuberculosis of the bladder, but had no effect.

Nitrate of Silver is now generally admitted to aggravate rather than benefit tuberculosis of the bladder.

In consideration of a few cures and a number of reported improvements following the use of instillations, it would appear that these procedures might merit a place in the treatment of bladder tuberculosis. Nevertheless, after personal observation of a certain number of patients and a careful study of the general literature, I am convinced that in the large majority of cases they do no good, whereas in some instances in which the more powerful drugs have been used—bichloride, nitrate of silver, and lactic acid—they have produced considerable damage. Personally, therefore, I neither use nor recommend them.

Irrigations with dilute solutions of silver, boric acid, bichloride, etc., have been given a very fair trial, more extensive than they deserve, and in the main have been found wanting. They do no good, and by distending the bladder they tend to aggravate the disease.

Rovsing has reported lately very satisfactory results from carbolic acid irrigations. He injects 100 cc. of a 0.5 per cent. watery solution and allows it to remain for 5 minutes, and then to flow out through a catheter; the process is repeated until the liquid returns clear. He treated 11 patients in this manner; 10 of them he reports as cured and 1 as greatly benefited. Certainly, the percentage of cures would seem to be remarkably high.

Summary.—When the primary focus is in the kidney, a nephrectomy should be done except in the very advanced cases and when the disease has become scattered. When it has originated in the epididymis, either an epididymectomy or castration is advisable, the choice of these procedures being governed by the extent of the disease. In those cases in which the infection has ascended to and implicated the prostate, the vesicles and the bladder, it is a question as to what is our best choice. In my opinion the operator should remove the diseased testicle or testicles along with the cord, and then wait for a while to see if this has any good effect on the prostate or vesicle; if improvement does not ensue, and the disease seems to be increasing, these organs ought to be excised, provided that the bladder is not too extensively affected, that the kidneys are free, and that there is no tuberculosis of the lungs or other organs. When the bladder, prostate, and vesicals have become infected secondarily to the kidney, a nephrectomy is to be recommended, and the remaining portion of the genito-urinary tract is to be left untouched at least for a while; later the enucleation of the prostate or vesicles may be considered. Complete removal of the seminal vesicles is an operation of magnitude and should be undertaken only after mature deliberation and then only by a skilful surgeon.

Irrigations of all kinds are useless and perhaps most of them are harmful. Instillations of all the stronger drugs are contraindicated. Iodoform in some cases may be of value.

The recent work of Wright and Douglas is full of promise, but it is too new to allow one to form an opinion as to its value.

In concluding this chapter on the treatment of bladder tuberculosis, I may be allowed to sum up the whole matter in one sentence:

Remove when possible the focus of bladder infection and send the patient to a suitable climate where he can live out of doors and where he will receive the proper quantities of well selected food. Surgical and medical treatment other than this has played a pitiful role.

(To be continued.)

DRAINAGE OF THE KNEE JOINT IN SEVERE INFECTIONS BY THE TRANSVERSE INCISION.*

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SEPTIC infection in the knee joint constitutes one of the most alarming conditions which the surgeon is called upon to meet.

The disastrous results both to limb and life render any procedure which can ameliorate its dire results and minimize the damage which inevitably follows worthy of serious consideration. Too often it has ended in amputation at or above the middle of the thigh, and not rarely in actual death from sepsis. In Flint's [8] valuable study of infection of the knee joint, of 237 clean cases operated upon for various conditions 11 cases (4.6 per cent.) were infected and required subsequent drainage. Of these one came to amputation. Thirty out of 52 penetrating wounds of the joint were infected (60 per cent.), and of the 30 infected cases 4 died with or without previous amputation, 2 recovered after amputation and 2 after resection, 20 recovered with varying degree of disability, 4 of the 20 having complete ankylosis.

In his summary of 62 infections demanding operation, there were 7 deaths, 4 recoveries following amputation and 2 following resections; 49 recoveries with disability varying from slight limitation of motion to complete ankylosis.

While these statistics show the disastrous results of knee-joint infection, they also show a sufficient number of recoveries with good or reasonably good functional results from the simpler methods of drainage to illustrate one point which I

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wish to make, *i.e.*, that the method to be described is applicable only to severe cases where the best results aimed at are to save life, avoid amputation and secure a useful limb without joint motion. It is second in severity to amputation only, and should be reserved for cases in which efforts at drainage and irrigation have failed to check the process, or in which the general sepsis is such a grave menace to life as to prohibit the trial of less radical procedures. Employed in such cases I believe that limbs may be saved that would otherwise be sacrificed, and that the general sepsis may be checked with less immediate risk and often with greater certainty than by thigh amputation during the height of the infection. The fresh wound area exposed to absorption of septic products is insignificant, compared to that of a thigh amputation performed in a condition where asepsis is practically unattainable, and instead of the great wound and freshly sawn bone, one has the untouched synovial membrane and articular surface to aid in protecting the general system from further invasion of the sepsis. The lesser shock is also an important advantage in many of these desperate cases.

While the transverse incision has been employed by many surgeons since C. H. Mayo's original report in the ANNALS OF SURGERY, January, 1895,[1] it has seemed to me that in many respects it has not received the attention it deserves. Important points in technique, difficulties which one meets in carrying a case to a successful outcome, the reasons for and against complete resection as a secondary procedure have either been ignored or briefly alluded to in the few case reports, personal and published, which I have been able to find.

Technique.—The technique employed in the cases which have come under my observation and in my own case is briefly as follows:

1. A transverse curved incision crossing the patellar ligament to the posterior border of the condyles and prolonged upward as a shallow U (Fig. 1).

2. Complete division of patellar ligament, anterior capsule, both crucial and both lateral ligaments, leaving the pos-

FIG. 1.—U-shaped incision crossing patellar ligament to posterior border of condyle on either side, and prolonged upward a short distance to allow the complete turning back of anterior flap upon the thigh.

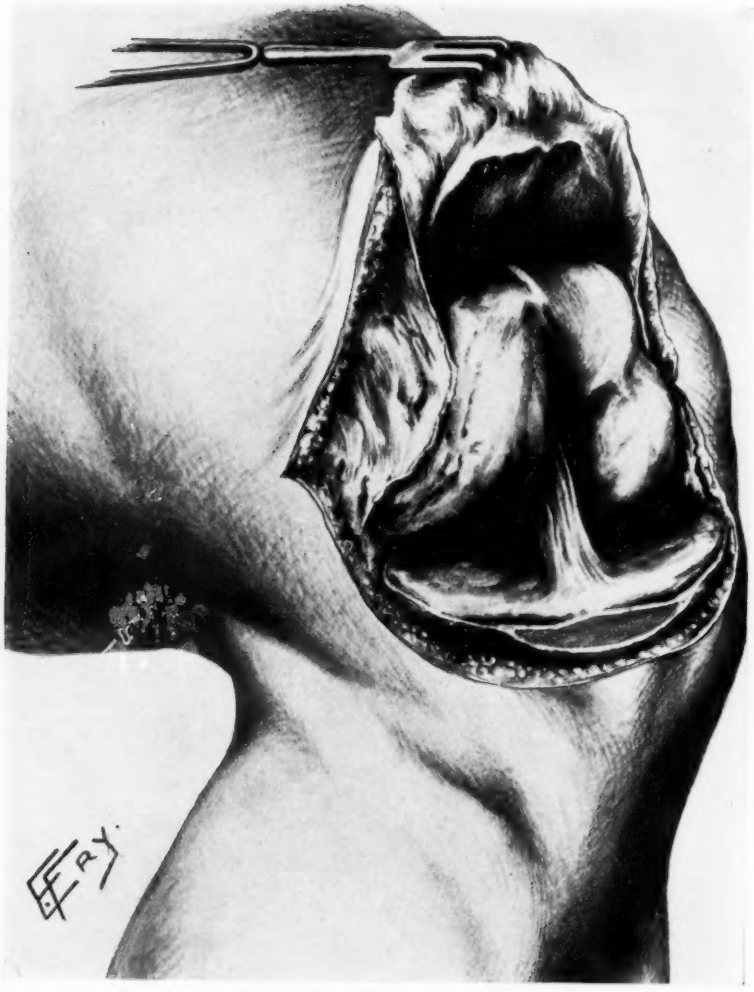

FIG. 2.—The patellar ligament, anterior capsular ligament and both lateral ligaments have been divided. The bones are still held firmly in contact by the crucial ligaments. The lateral expansions of the quadriceps prevent the turning back of the patella and free opening of the bursa.

FIG. 3.—The crucial ligaments are divided, allowing the bones to drop apart. The lateral expansions of the quadriceps tendon are freely cut, the anterior flap everted and stitched to the thigh. The posterior recesses of the joint and the quadriceps bursa are now widely opened.

terior ligament alone intact, allowing separation of the bones and opening widely the posterior recesses of the joint. (See Fig. 3.)

3. Lateral cuts through wall of quadriceps bursa, muscle and aponeurosis, allowing the complete turning back of the anterior flap, including the patella and all tissues down to the joint, which is then fastened to the skin of the anterior aspect of the thigh with a suture of heavy silk, opening the great bursa widely to its apex (Fig. 3).

(Fig. 2 shows the incision before the division of the crucial ligaments and the lateral cuts. The bones are still firmly held together and the posterior recesses of the joint imperfectly drained. The patella and skin flap cannot be everted, and the upper part of the joint cavity and quadriceps bursa are insufficiently opened.)

4. Light packing of the entire joint with gauze moistened with a weak solution of bichloride or formalin and fixation of the limb in flexion (between 60 and 80 degrees) on a suitable splint.

5. Secondary resection of the joint after suppuration has ceased, the temperature is practically normal, and the joint and wound surfaces are covered with healthy granulations.

In cases severe enough to justify this method ankylosis is a foregone conclusion. Attempts to straighten the limb without resection are attended with great difficulty, owing to contracture of the hamstring muscles, and the tendency to posterior dislocation of the tibia. Contraction of the skin flap leaves a broad area across the anterior aspect of the joint, covered with hummocks of granulations, which heals slowly or demands subsequent skin grafting.

Ankylosis between articular surfaces not resected takes place slowly and uncertainly, and if imperfect with just enough motion to cause pain is far less desirable than firm union of sawn bone.

Resection seems, therefore, the preferable secondary procedure if the technique described is followed. The bony apposition is accurate and union firm; the skin flaps can be nearly

or quite approximated; and if done at the proper time, clean and prompt healing may be expected. The shortening should not exceed 1¼ to 1½ inches, and does not add greatly to the disability. In children who have not attained their growth, however, the danger of excessive shortening from damage to the epiphysis is an important consideration.

From information kindly given me by Dr. R. F. Weir and from C. H. Mayo's original case report, the technique employed by W. J. and C. H. Mayo, as I understand it, differs radically in some important respects from that which I have above described.

The patella is divided transversely, the crucial ligaments are not cut and resection is not done as a secondary procedure. After the joint is clean, the attempt is made to suture the patella or its ligaments, the limb is straightened, and partial restoration of function is aimed at and obtained in some of the cases.

It would seem that this procedure should occupy a place between the simpler methods of drainage and the more radical method described, reserving the latter for cases in which secondary resection is the definite end in view. If the process can be safely checked without division of the crucial ligaments, and with preservation of even a limited range of motion, it is unquestionably the better method, and in certain cases this attempt might be made, leaving the division of the crucials to be done subsequently if needed.

There are cases of the more severe types, however, in which nothing short of the complete operation, opening widely every recess of the joint will save limb or life. In an unpublished case reported to me personally in which the crucial ligaments were not divided the process was not satisfactorily checked; the case recovered with complete ankylosis and posterior displacement of the tibia after prolonged suppuration during the course of which the crucial ligaments sloughed away.

The advantages of the operation over immediate resection are that it greatly lessens the danger of failure of union from

suppuration, septic osteomyelitis, or death from sepsis as a result of the operation. Even if amputation should become necessary later, the free joint drainage as a preliminary step should lessen the danger of that procedure.

After Treatment.—The after treatment is of great importance; cleanliness is difficult to maintain, dressings are exceedingly painful and the greatest patience, gentleness and care in their performance is necessary.

The limb should be fixed in flexion (60° to 80°) on a bent wire splint, molded plaster of Paris triangle or some suitable apparatus. The entire region of the joint and wound, and often the site of secondary abscesses in thigh or leg must be left accessible for dressings. Pressure on the popliteal vessels, with consequent œdema of the leg, as well as pressure sores on the heel or other bony points, must be carefully guarded against. The everted skin flap should be separated from the thigh by strips of gauze.

It usually requires from three to eight weeks for suppuration to cease and the joint and wound surfaces to become sufficiently clean to permit of straightening of the limb or secondary resection.

The history of the following case illustrates some of the points dwelt upon in the preceding remarks:

B. T., 21 years of age, a Greek peddler, was brought from Bellevue to the French Hospital on June 23, 1906, with a history of having received some injury to the right knee about May 15, 1906, which resulted in infection of the joint. Multiple drainage openings were made, and at the time of his admission to the French Hospital, thirty-nine days after the original injury, there was an advanced stage of suppurative arthritis with abscesses in the muscular planes of the thigh, and disorganization of the joint. The temperature ranged from 100.5 to 102.5 degrees, pulse 104 to 120.

Blood examination showed 17,400 leukocytes, 85.4 per cent. polynuclear cells. Blood culture was negative; cultures from pus in knee showed staphyloccoccus aureus in pure culture. The constitutional effects of chronic sepsis were marked, and it seemed

as though amputation would be necessary. It was determined however to first try the method of drainage by transverse opening of the joint, and operation was performed on June 28, 1906. A transverse curved incision was made crossing the patellar ligament, extending to the posterior part of the condyle on either side. From that point it was prolonged upward sufficiently to allow of eversion of the flap, which consisted of all the tissues down to the joint, including patella and anterior wall of the great bursa. The patellar ligament, the anterior capsule, both lateral ligaments and both crucial ligaments were divided, the posterior ligament alone being left intact. The eversion of the flap above referred to was then accomplished by making lateral cuts through the muscle and fascia, laying the quadriceps bursa widely open to its apex. The leg was flexed to an angle of about 60 degrees, the ends of the bones easily separating for an inch or more, and every recess of the joint was widely opened.

The suppurating tracts in the thigh were then freely opened and drained, and the limb put up in flexion on a triangular plaster splint. This had been constructed so as to avoid pressure on the popliteal vessels and interference with the circulation of the leg.

The temperature fell gradually, remaining below 100 after the twelfth day. The general condition improved, suppuration diminished and at the end of three weeks the entire wound surface was covered with healthy granulations.

Resection of the joint was done on July 19, 1906, twenty-one days after the first operation. Contraction of the flap and of the hamstring muscle made removal of 1¼ to 1½ inches of bone necessary in order to approximate the skin edges, and secure good position of the limb. The sawn ends were fastened together with heavy silver wire. The patella was excised and the quadriceps and patellar tendons sutured together. Even with the removal of bone, retraction of the skin flap rendered perfect apposition impossible and narrow gaps between the few tension sutures inserted were left to heal by granulation. Healing was satisfactory and clean; bony union good and on September 20 the wires were removed, and the patient allowed to walk about with only a short splint. He remained about the wards and was quite content to act as a helper until November 1, when he was discharged able to walk easily without the assistance of a cane.

I am indebted to Dr. Weir for permission to mention two other unpublished cases which have come under his care.

The first was a man 25 years of age, admitted to Roosevelt Hospital on March 8, 1900. He had received a penetrating wound of a knee joint two days before admission. Infection had occurred and the joint was irrigated and drained through incisions on either side of the patella.

Suppuration continued, and on April 3 the joint was opened transversely, the crucial ligaments divided and the U-shaped flap turned upward and fastened by suture in that position. The limb was treated in flexion of 30 degrees on wire splints. On April 22, the patient coming then under the charge of Dr. Weir, extension was applied to the flap. The temperature which had not gone to normal however continued to rise, reaching 105.4 on May 6, 106.2 on May 7. On May 8 thigh amputation was performed. Good recovery followed and the patient left the hospital improved on July 4, 1900.

The second case was a boy of 6 years, admitted to Roosevelt Hospital on October 16, 1905, under the charge of Dr. Brewer, with a penetrating wound of the knee joint. Lateral incisions, irrigation and tube drainage were first tried, but symptoms of sepsis continued and six days later Dr. Brewer laid the joint freely open by a transverse incision, dividing the crucial ligaments and turning the patella upward. The case came under the care of Dr. Weir soon after, and on December 4, forty-three days after the transverse opening of the joint, resection was performed. Suppuration had ceased and the joint and wound surfaces were covered with healthy granulations. The temperature had been practically normal for some time. Resection was decided upon only after the great difficulty in overcoming the posterior displacement of the tibia and dealing with the contracted skin flap had been demonstrated. The patella was excised, a thin slice of bone removed from tibia and femur and the bones wired. Recovery was satisfactory and uneventful, bony union was firm and healing without suppuration. The patient was about ready for discharge when he developed measles in the ward and was transferred on January 21, 1906.

A third unpublished case was one in which the typical operation was performed by Dr. Brewer on a man suffering with

infected wound of the knee joint, on August 30, 1901, the crucial ligaments being divided, the flap sutured back, and the limb treated in flexion. Lateral incisions, irrigation and drainage done August 19 had failed to control sepsis.

The case was progressing favorably but not yet in a condition to warrant straightening of the limb, when he was removed from the hospital by his friends, against advice, on September 16, 1901, eighteen days after the operation.

Dr. Blake has given me notes of an unpublished case of non-traumatic suppurative arthritis in which transverse opening of the joint and turning up a U-shaped flap was done on a child 11 months of age, March 26, 1901. The crucial ligaments were not divided. The process rapidly subsided and the limb was straightened without resection nine days later. Shortly afterward the child developed scarlet fever, and was transferred. Healing was not complete at the time of transfer but suppuration had ceased and the local condition was progressing favorably.

Dr. Lilienthal has had three unpublished cases, which recovered with ankylosis, all in children. The joint was opened transversely and the crucial ligaments were divided; the limb treated in flexion, but instead of everting and fastening back the flap, it was split, through its centre to the apex of the bursa by a separate longitudinal incision after removing the patella. The limb was straightened without resection in all of the cases.

I have been unable to find a sufficient number of recorded cases to draw statistical conclusions of any value.

C. H. MAYO published his original case in 1895 and four subsequent cases in 1897,[3] all recovered, two of the five having partial joint motion, stated to be about one-quarter of the normal range. In three only was it possible to re-suture the divided patella.

GERSTER reported two cases in 1895,[2] mentioning the ugly scar resulting in one case, a girl of 8 years of age, straightened without resection 38 days after the primary operation. He commended the method as described by Mayo, but gave few details as to technique.

BREWER, in 1901,[5] published a case in which good recovery followed the complete operation, with division of the crucial ligaments and fastening back of the flap. Resection was done 6 weeks after the primary operation. The case was one of marked severity, with profound sepsis and joint destruction.

WHITEHEAD[6] reported a case in which infection followed an operation

which he had performed for excision of a semilunar cartilage, in which incisions, irrigation and drainage failed to control sepsis, and the joint was opened by the transverse method 15 days after the primary operation. Fifteen days later the limb was straightened and half the patella excised; subsequent Thiersch grafting was necessary to complete the healing. He considered the method original.

MAITLAND published a case in 1905,[3] in which straightening without resection was done 13 days after the primary operation, resulting in recovery with ankylosis.

Of these cases, none are mentioned as having recovered any joint motion, except the two in Mayo's series.

W. J. MAYO, in 1901,[4] wrote regarding the method, reporting recovery with 60 per cent. of the normal range of motion in some of the cases.

Résumé.—The operation should not be employed in mild or early cases, in which there is hope of recovery with some preservation of joint function, drainage and irrigation through multiple incisions being preferable.

A distinction should be drawn between cases in which the crucial ligaments are preserved and straightening the limb without resection, resuturing the patella or its ligament and preserving some degree of function is the end in view; and the severer cases where avoidance of amputation or death from sepsis are the sole considerations.

In the latter class of cases the complete operation is of great value, and should as a rule be followed by resection as a secondary procedure, except in children.

With the enormous raw surface exposed, dressings are exceedingly painful and cleanliness difficult to maintain. Pressure on the popliteal vessels with œdema of the leg, and pressure sores in the protracted cases must be carefully guarded against. Flexion of at least 45 per cent. on a suitable splint is essential. Satisfactory straightening of the limb without resection is often difficult and sometimes impossible on account of shortening of the hamstring muscles and contraction of the skin flap.

The secondary operation should not be performed until suppuration has ceased, surfaces are cleanly granulating and temperature is practically normal, a period of from 3 to 8 weeks being usually required.

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DIFFUSE CAVERNOUS ANGEIOMA OF THE UPPER EXTREMITY.*

BY ASTLEY PASTON COOPER ASHHURST, M.D.

OF PHILADELPHIA.

MAMIE McC., 12 years of age, applied to the Out-Patient Department of the Episcopal Hospital on October 16, 1906. She complained of disability of the right arm. On drawing up the patient's sleeve a cystic swelling was seen on the extensor surface of the forearm, just above the wrist. This was thought at first to be a tuberculous cyst, but when the whole upper extremity and thorax were exposed, the following condition was found: The front of the thorax on the right side is the seat of a nævoid formation composed of dilated capillaries or venules, giving the whole right pectoral region a distinctly bluish tinge. The discoloration is abruptly limited at about the mid-sternal line, and below by a line passing transversely through the tip of the ensiform process. The area affected is not raised above the surrounding healthy skin. Posteriorly the nævoid condition is not so marked; but below the angle of the right scapula a mass, about the size of a walnut, can be palpated. It feels like a lipoma. Just over the middle of the right clavicle is an angeiomatous mass, somewhat larger than a split pea, dark blue, protruding, and quite hard. Another similar phlebolith may be felt in the anterior axillary fold. In the right supraspinous fossa, at a point corresponding to the free margin of the trapezius muscle, is a somewhat larger bluish mass, which protrudes distinctly from the surface of the skin in this region, is compressible, and is evidently composed of cavernous tissue. An area of bluish discoloration, not raised above the surrounding skin, may be seen below the point of the shoulder, over the deltoid muscle.

The skin of the arm, forearm, and hand presents no abnormalities in structure, but the whole upper extremity is slightly livid, and there is œdema of the fingers and hand. On the exten-

* Read before the Philadelphia Academy of Surgery, December 3, 1906.

sor surface of the forearm, as already noted, there is a cystic, compressible swelling, not circumscribed, about the size of an egg. The flexor surface of the forearm in its upper half is also somewhat enlarged, and is indistinctly cystic. Elevation of the hand above the head causes an almost total disappearance of these swellings in the forearm, while they quickly reappear when the hand is lowered. By compressing the arm below the shoulder the hand and forearm quickly become alarmingly distended, the cystic swelling becomes bluish and very tense, and pain produced.

The circumference of the forearm above the wrist, when the hand is down, is 14 cm., but is only 11.5 cm. when the hand is elevated above the head. The circumference of the forearm below the elbow is 20.5 cm. when the hand is down, 18 cm. when it is raised. The circumference of the arm above the elbow is 19.5 cm. when the hand is down, only 17.5 cm. when it is raised. The measurements of the corresponding parts of the left upper extremity are: Above the wrist, 13 cm.; below the elbow, 19 cm.; above the elbow, 20 cm.

The length of the right upper extremity from the acromion to the tip of the styloid process of the ulna, the elbow being extended, is 41 cm.; that of the left is 43 cm.

The superficial veins of the affected forearm are not visible, even when the hand has been hanging down for some time.

The heart appears to be normal both in location and action. No abnormality in the other thoracic structures has been detected. The axillary, brachial, radial and ulnar arteries pulsate with fair regularity in their normal situations. The radial pulse, synchronous in both arms, varies from 90 to 100 per minute when the angeiomatous arm is raised; and is about 120 per minute when it is dependent.

The cystic swelling above the wrist may be partly lipomatous in character, as it does not entirely disappear when the hand is elevated, some palpable irregularities persisting in the subcutaneous tissues. It is impossible to detect the extensor tendons by palpation.

Skiagraphs were made of the clavicular and cervical regions, and of the forearm. The former was entirely negative; the later possibly shows some atrophy of the bones of the forearm.

Although the condition in this patient is congenital, it is only within the last few months that she has been disabled. Her

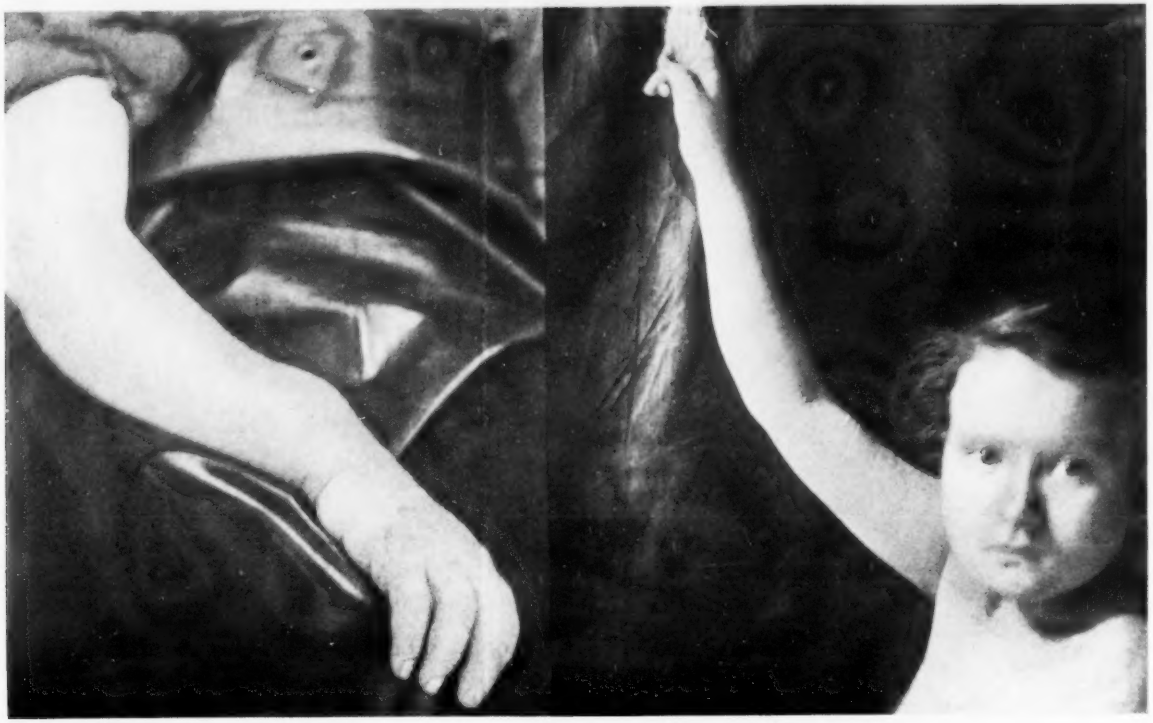

FIG. 1.--Showing increase in swelling when hand is down.

FIG. 2.—Showing decrease in swelling when hand is elevated.

family and her previous personal histories are negative. Her arm was always weak, and it was known that there was something wrong with it, but no particular attention was paid to it. She attended school regularly, and until the close of the session last summer was able to write and figure with her right hand. Of late the fingers and even the hand have become numb; the grasp is so feeble as to be practically absent,* and though she has resumed her school this autumn, she is no longer able to hold a pencil. There is present almost constantly a dull aching pain, which is considerably relieved by firm bandaging. A flannel bandage is applied with the hand elevated well above the head, and the arm is carried in a sling. General health good.

The following classification of angeiomata, taken from Mauclaire and de Bovis, considerably simplifies their description:

- External
  - Superficial
    - Skin and external mucous membrane.
    - Subcutaneous and submucous tissues.
  - Deep
    - Intermuscular tissues.
    - Muscles.
    - Orbit and antrum of Highmore.
    - Periosteum and bones.
    - Subsynovial tissues.
    - Glands.
- Internal
  - Subserous: meninges, peritoneum, etc.
  - Visceral: liver, spleen, etc.

These tumors are further classified as circumscribed and diffuse. The angeiomatous condition in the present patient appears therefore to be chiefly of the diffuse subcutaneous cavernous variety; although, as is not unfrequently the case, the neoplasm is really of mixed chaacter, being cutaneous in small areas, as in the supraspinous fossa; and in the pectoral region is of the telangiectatic cutaneous variety, while in the forearm the growth undoubtedly involves the intermuscular planes, and has probably destroyed most of the muscular tissue.

* At present (February) the grasp is noticeably stronger.

Duplay and Cazin remark that subcutaneous angeiomata closely resemble cold abscesses in appearance, and it will be remembered that in the present case the swelling on the dorsum of the forearm was at first sight thought to be of tuberculous origin. The best clinical description of the cavernous angioma that I have been able to find is that given by Weinlechner, in Gerhardt's system.

Angeiomata of the extremities are rather unusual, and those of the diffuse cavernous type appear to be quite rare. Of all forms of angioma, including the ordinary mother's mark, the usual location is the head, and the least usual the limbs, as may be seen from the following table:

Head and neck..... 57 per cent. (Kramer), 79 per cent. (Gessler).
Trunk..... 28 per cent. (Kramer), 11 per cent. (Gessler).
Extremities.....12.5 per cent. (Kramer), 9 per cent. (Gessler).

The question of treatment in these cases is as unsatisfactory as their pathology is obscure. Excision is scarcely possible in the diffuse form, though in cases of circumscribed cavernous angeiomata, whether cutaneous or subcutaneous, it is sometimes feasible, and is usually followed by permanent cure. Amputation at the shoulder joint, the most radical form of treatment available in the present case, might prove a remedy more serious than the disease itself; and in view of the implication of the pectoral and scapular regions might be followed by increase of the angeiomatous condition in the parts that were not removed. The injection of boiling water or other fluids, is a method neither invariably successful, nor entirely safe. Boiling water is much less dangerous than caustic or coagulating fluids, and in the hands of Dr. Wyeth, the originator of the method, has not, I believe, been attended by untoward effects. Other surgeons, however, without his experience, have been less fortunate. Payr has reported eight or nine cases of angeioma treated successfully by the introduction of magnesium darts in the growth. The little darts, or tacks, as they have been called, are soon absorbed, but they induce the formation of compact connective tissue with throm-

bosis and obliteration of the blood spaces. Heide has quite recently treated a patient afflicted with a diffuse cavernous subcutaneous angeioma of the lower extremity by means of electrolysis, and has obtained results which he considered satisfactory. He used a current of from 30 to 40 milliampères, for 3 or 4 minutes at each sitting. He began in the gluteal region, and gradually worked down to the foot; but the foot itself was not benefitted by the treatment, as the angeiomatous swelling could no longer be made to disappear when the foot was elevated. Another result of the obliteration of the cavernous spaces and of the connective-tissue formation was that during the last sittings the hæmorrhage became considerably diminished in amount.

A brief abstract of all the similar cases it has been possible to find in a somewhat extensive search of the literature is appended.

(1) ABBE reported the case of a young man with an angeiomatous condition apparently more cutaneous than subcutaneous, involving the whole right upper extremity. The skin was very thin, and the slightest scratch was liable to cause profuse hæmorrhage.

(2) AUDRY.—A female, aged 20 years, whose left upper extremity had always been larger than her right, had been troubled with its more rapid growth since the age of 8 or 9 years. The left hand and forearm to lower third of arm were very œdematous, spongy and compressible to touch. Ulcers formed in fingers, and arm was amputated through upper third of humerus, to hinder further infection. Dissection showed that the skin was thickened and elephantiasis-like in character. Beneath skin was a diffuse cavernous angeioma, extending to bones, eroding them and destroying muscles and smaller nerves. The arteries were normal. The left scapular region was also affected, but it was more lipomatous in character than the forearm. The skin was nowhere nævoid throughout the upper extremity.

(3) COLEY recorded the case of a girl of nineteen years, whose fingers and the extensor surface of whose left forearm above the wrist were the seat of an angeioma cavernosum, apparently diffuse and subcutaneous, although this is not stated. The swelling of the forearm was the size of an egg. Over the left scapula was a lipogenous angeioma, the size of a cocoanut. All these swellings were adherent to the skin. The hand and forearm were bluish in color. The scapular growth was excised, and found to be an extremely vascular lipoma. An attempt was made to excise the growths from the fingers, but the operation was abandoned on account of hæmorrhage. Good illustrations accompany the report.

(4) CRUVEILHIER.—Female, 75 years, paralytic, demented, blind, no history. Left hemiplegia. The left upper extremity was flexed, rigid, and covered with varicose cutaneous and subcutaneous tumors. Autopsy showed that the subcutaneous tissues and muscles were the seat of a diffuse cavernous angeioma; the skin was invaded in some parts, and in these regions bluish masses of varicose veins protruded. Several phleboliths were present.

(5) HEIDE.—Boy of 12 years, presented a diffuse angeioma of the left lower extremity, involving buttock, back of thigh, popliteal space, fibular surface of leg, and dorsum of the foot. The skin was bluish, and prominent in places (cutaneous), although the main growth was subcutaneous and muscular. The circumference of the limb when dependent was 3 to 4 cm. greater than when elevated above level of trunk. Muscular power was very weak. A small piece of tumor was excised for examination; after cutting through the subcutaneous tissues, the deep fascia was seen, dark blue in color; on excising it the underlying tissue bulged out hernia-like, and looked like a mass of extremely thin walled veins, blackish blue in color. No trace of muscular tissue was visible microscopically, but under the microscope were observed a few atrophic muscle fibres, their place being taken by fatty and connective tissue. The cavernous spaces were lined with endothelium. The treatment adopted has already been described.

(6) LAMORIER.—Man, aged 70 years, the whole right upper extremity being affected, including the pectoral and scapular regions. The skin was bluish black, the angeioma was diffuse, and on elevation of the hand the swelling rapidly disappeared from the hand, forearm and arm, and a larger swelling appeared in the pectoral and scapular regions. The condition was congenital, not painful; and autopsy showed all the muscles converted into a splenoid or placenta-like tissue.

(7) LICHTENSTEIN.—Man of 36 years, with diffuse subcutaneous cavernous angeioma of right hand and forearm. At birth a small nodule was present on finger, and this was operated on in childhood. The angeioma gradually extended up the forearm. The hand was œdematous and the forearm was the seat of a distinct swelling. The skin was not discolored except at scar of old operation. A few phleboliths were palpable. Superficial veins were not noticeable. The pulsation in the arteries was normal. There was no pulsation in the tumors. The patient was directed to wear an elastic bandage.

(8) LICHTENSTEIN.—A boy aged 7 years. At birth the left upper thoracic region and the left arm were somewhat blue; soon a lump the size of a small pea was noticed on the nipple, and another on the knuckle of the fourth finger. Four weeks before examination these lumps reached the size of large peas, and developed the characteristics of cavernous angeiomata. The left upper extremity was shorter than the right by 3.5 cm. The superficial veins were not prominent, but there was present a diffuse cavernous angeioma of the hand, forearm and arm; the axilla was full, no axillary folds being present. The pectoral region was bluish, and one small mass was palpable. Above the clavicle there

was a bluish line of veins. The skin of arm and forearm was distended when the hand was down, but became flaccid when it was elevated. The skin was involved, the angeiomatous condition having started apparently as subcutaneous in character, and later involving the cutaneous tissues. The arteries were normal, but the pulse was 80 when the arm was dependent, and only 64 when it was raised. No treatment is mentioned.

(9) RICHET.—A boy of 11 years, with a diffuse cavernous angeioma of the subcutaneous variety on the lower two-thirds of the flexor surface of the forearm, involving also, by extension under the annular ligament at the wrist, part of the thenar eminence, in which latter situation the growth was rather of the cutaneous variety. The flexor tendons could not be palpated. The tumor was painful on pressure, and pressure caused it almost to disappear. Elevation of the hand rendered the color of the overlying skin nearly normal, and allowing the arm to hang down made it a deep violet blue, and on the thenar eminence a few varicose veins then became visible. The swelling of the forearm had neither pulsation nor bruit. This condition had lasted only 20 months. Treatment by injections of perchloride of iron was instituted, and when the patient was seen one year later, the swelling on the forearm was firm in consistency, little nodules being palpable wherever injections had been made. The tumor could no longer be made to disappear by pressure, and in the upper part of the forearm there was still evidence of the persistence of the cavernous condition. The skin had become even whiter than on the sound arm.

(10) ROKITANSKY.—Male adult, subcutaneous diffuse cavernous angeioma, involving whole right upper extremity, and extending past axilla on to thorax. In certain regions soft bluish masses, feeling like lung tissue, projected from the surface of the limb.

(11) SCHUH.—Young man, subcutaneous diffuse cavernous angeioma of anterior aspect of foot, extending up to knee. The growth had extended through everything down to the bone. Skin was scarcely at all affected, but was livid when limb was dependent. Many phleboliths. If the patient stood up the limb grew to an enormous thickness, and became blue and tense; but no varicose veins were visible. All the tissues between skin and bone seemed to have been destroyed by the tumor. It had not increased in the last 12 years, and with an elastic stocking patient was able to walk and even swim.

(12) SCHUH.—Young man, without known cause, suddenly developed growth on hand which rapidly extended up to middle of forearm. The skin was nævoid in places, and very thin. Elevation of limb caused skin to lie in loose folds, and outlines of bones could be easily felt. Phleboliths were palpable. No enlarged superficial veins could be detected. Amputation was refused, and the patient died a year later of phthisis.

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FRACTURE OF THE CORACOID PROCESS OF THE SCAPULA CAUSED BY MUSCULAR ACTION.*

WITH REPORT OF CASE.

BY ORLANDO H. PETTY, M.D.

OF PHILADELPHIA.

The following is my record of the case:

A man, 57 years of age, a trolley car conductor by occupation, while trying to forcibly put a drunken man off of his car, experienced a sudden and severe pain in his right shoulder, which practically rendered his right arm useless. He is sure that he neither fell, nor that his shoulder was struck in any manner. At the onset of the sudden and severe pain he was steadying himself by holding to the hand rod on the rear platform of the car with his left hand, the passenger being on the same level as the conductor, and was pulling with all his strength through his right arm trying to expel the disorderly passenger. During the several hours following the accident that he remained at work, he experienced severe pain in the right shoulder and an inability to use his right arm in ringing up fares or signalling the motorman.

The patient is a well developed, powerfully muscled man. When he presented himself to me, October 15, 1906, he was unable to raise his right arm from his side. He could elevate his shoulder but could not shrug it forward, although he could, with little discomfort, throw his shoulder backward, after it had been pushed forward.

The function of his forearm and hand was unimpaired. Examination revealed nothing wrong in the shoulder joint, clavicle, or acromion process, but severe pain was induced when pressure was applied over the coracoid process, and bony crepitus was elicited in this area.

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* Read before the Philadelphia Academy of Surgery, December 3, 1906.

A fracture of the coracoid process being evident, the right arm was dressed in the Velpeau position, and later in the evening Dr. Fussell saw the case with me and confirmed the diagnosis. As the patient experienced great inconvenience from the Velpeau position, the dressing was changed, binding the right arm to his side, and leaving his forearm free.

Two or three days later, Dr. Pancoast of the University of Pennsylvania Hospital, took a skiagraph of the injured shoulder, and it revealed a fracture at the middle portion of the coracoid process, with a tipping downward and inward of the distal portion of the process. Dr. Pancoast said there had been many patients referred to him with a clinical diagnosis of uncomplicated fractured coracoid, but that this was the first case to be confirmed by the X-ray findings.

Result.—About the middle of the sixth week, crepitus having disappeared and the fracture apparently firmly united, the shoulder was treated by light massage and passive motion. He returned to work at the end of the seventh week. He is still unable to raise his right arm high above his head.

Fracture of the coracoid process of the scapula is not common, and an uncomplicated fracture of this process is a rare condition, while of its fracture by muscular force I could find but three cases mentioned. One of these was evidently discovered in the cadaver during dissection, another observed by Hulme, and the third a brief reference to a case of Stimson. These reports will be fully referred to later in this paper.

It is interesting to note the opinions of the earlier authors upon this fracture.

MALGAIGNE says: "This fracture is excessively rare, and does not occur except in company with other fractures and enormous contusion of the soft parts, so the case is generally of the gravest nature."

In S. D. GROSS's System of Surgery, 1864, we find the following comment: "The coracoid process is sometimes broken in consequence of a severe fall or blow, generally a short distance from its tip, the fracture being usually accompanied with great contusion of the soft parts."

ASHHURST, in Erichsen's "Science and Anatomy of Surgery in 1869," says: "The coracoid process is seldom broken, there not being more than ten or twelve unequivocal cases of this accident on record. It cannot

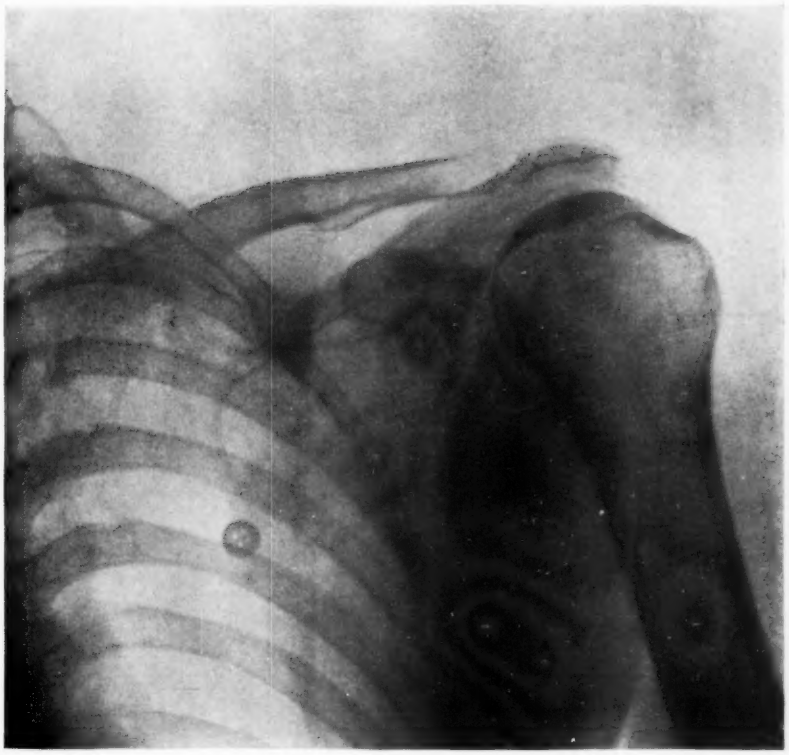

FIG. 1.—Fracture of coracoid process of scapula. Tip tilted inward.

happen except by direct violence." And even in a work as late as Scudder's "Treatment of Fractures," second edition, the coracoid process of the scapula is not mentioned as ever being the seat of a fracture.

Prof. EDWARD BENNETT of Trinity College, Dublin, in 1873, in reporting a case of epiphyseal separation of the coracoid process in a child of 6 years of age, caused by a crushing force, concluded with the following: "This specimen is of particular interest in as far as it completes the series of coracoid fractures in our collection, which contains already several specimens of the fracture associated with the dislocation of the humerus, a specimen of fracture from muscular action and fractures from direct injury in the adult."

J. Wellington Byers, of North Carolina, reviewed the fractures of the coracoid process up to 1885, and collected a score and a half of authentic cases of coracoid fracture but found none caused by muscular action. The following are his remarks on the etiology of the condition: "To class these injuries according to the manner of causation, it will be found that nearly half of them result from falls upon the shoulder, the others resulting from direct blows."

Byers either discredited or overlooked a case of fracture of the coracoid process by muscular action, reported in the *Lancet* in November, 1873, and thus described by HULME:

"T. H., æt. 57, miner. Three weeks previously he was on a bank in the act of passing through a wire fence when he slipped and in falling his left arm caught in one of the wires. He instantly felt a severe pain in the fingers, followed by loss of power in the arm and inability to raise the arm from the side. On examination it was found that the coracoid process of the left scapula was fractured and drawn downward."

R. CLEMENT LUCAS in Guys Hospital Reports, 1890, gives five methods of fracture of the coracoid process of the scapula.

(1) Direct violence. (2) By dislocation of the humerus. (3) By extreme flexion of the shoulder joint, when the coracoid process is thrown into forcible contact with the under surface of the clavicle. (4) By downward crushing of the clavicle upon it. (5) By sudden muscular action.

Mr. ARBUTHNOT LANE in 1887 first called attention to the extreme flexion of the shoulder joint as a probable cause of fracture of the coracoid and cited as instances two cases quoted by HULKE in Holme's System of Surgery. They are thus described:

"Two cases of fracture of the coracoid process have come under my notice. In both the fracture was caused by a fall forward from a slight height, with the arms stretched forward. There was mobility of the tip of the process with crepitus and pain, but not displacement."

The comments of LUCAS are: "If this account be correct, Mr. Lane's explanation would appear to be the only possible one."

If the opinion of Mr. Lucas explains the two cases observed by Hulke, I think the theory of Lane, that extreme flexion may be the cause of the fracture, applies equally as forcibly to the case I have just quoted, which Hulme attributes to muscular action, for Hulme says that in falling the patient caught his left hand in one of the wires of the fence; this it seems to me would cause extreme flexion of the shoulder. The specimen referred to by Bennett, as being caused by muscular action, is in the museum of Trinity College, Dublin. There being no record of an examination at the time of accident and no history of the case, its etiology can hardly be considered unequivocal.

Stimson, in his work on fractures and dislocations, speaks of the fracture of the coracoid process of the scapula in this manner:

"This may be caused by muscular action or by direct or indirect violence. In the former the causative effort is sometimes comparatively slight, wringing of wet clothes in one case, but more often is a powerful effort made with the arm.

In reviewing the literature I have carefully read all the reports and reviews of the cases that I could find and found no case caused by muscular action, that had a full history of the accident and physical examination confirmed by skiagraph.

REPORT OF OPERATIONS

PERFORMED AT THE PUBLIC CLINICS FOR STUDENTS AT THE GERMAN HOSPITAL OF PHILADELPHIA, DURING THE SESSION OF 1905 TO 1906.*

BY JOHN B. DEAVER, M.D.,

OF PHILADELPHIA.

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TWENTY-SIX clinics were held at which there were 215 patients operated upon, with a total of 244 operations. It was found necessary to peform 52 operations on 23 patients at the same sitting. The mortality was 9 cases, or 4.2 per cent.

APPENDIX.—There were 64 cases of *appendicitis* operated upon, of which 39 were acute. Of the patients with acute appendicitis there were 29 males and 10 females. The appendix was found acutely diseased and removed at the same time in 4 patients operated upon for other conditions in which it was involved; of these patients 1 was a male and 3 females. In these 64 cases there was 1 death, that of an acute case in a male. The average duration of the attack for which the acute cases were operated upon, estimating from the onset of the attack up to the time of operation, was, in the 23 cases without abscess, 4 3-10 days, and in the 16 cases with abscess, 8 days. Seven of the 23 non-abscess cases were operated upon in their first attack, 9 of the 16 abscess cases had had no previous attacks.

The incision varied according to the pre-operative findings. Of these acute cases, in 12 the McBurney or gridiron incision was made; in 19 the incision was made either through or at the outer border of the right rectus, and of these, in 2 cases it was necessary to make a counter-incision in the right flank for extra drainage, and in 2 others, a small suprapubic incision for tubal drainage of the pelvis. The 8 remaining

* Read before the Philadelphia Academy of Surgery, December 3, 1906.

cases required extraperitoneal incisions, of which 3 were assisted by suprapubic counter-incisions, and 1 by a counter flank-incision. In 2 cases the pelvic exudate was drained by a tube emerging from the incision in the right rectus muscle.

In 7 cases there was free pus in the pelvis at the time of operation, in 10 there was an abscess near the cæcum, and in 9 the intestines were covered with lymph or pus exudate.

The appendix was subcæcal in 16 cases, to the outer side of the cæcum in 6, in one of which the organ ran up toward the liver, to the inner side in 3, and in 5 cases to the brim of the pelvis or into the pelvis. In 4 cases the pathological condition was so severe as not to warrant searching for the organ, or removing it even when seen. (In the remaining 6 cases, the position of the appendix was not stated.) The organ was necrotic or gangrenous in 9 cases, perforated in 4, kinked in 2, and the remainder were either adherent, congested, swollen, or covered with inflammatory exudate. When possible the appendix was wholly amputated flush with the cæcum, the resulting gap being closed by two semicircular silk sutures which intertwined at each pole of the organ, and in some few cases in which stump-amputation was performed, the invagination was maintained by a silk purse-string suture. The badly diseased appendices were ligated near their bases with catgut and the stump-surface cauterized with liquified carbolic acid, no invagination being performed.

Drainage was required in 15 of the 39 acute cases, and consisted of gauze in 6 cases, glass drainage tube with gauze in 8, and glass tube alone in 1. In the remaining 19 cases, the wounds were closed with tier sutures of chromicized catgut. The majority of the leukocyte counts maintained a direct ratio with the severity of the case. In many abscess cases in which the urine was examined shortly after admission and previous to operation, there was found a marked toxic nephritis which subsided within a day or two after operation. This deleterious action of the pus upon the economy in general and the kidneys in particular, not to mention the peritoneum, we consider a strong argument against postponing operative measures.

A young woman, whose first attack was two weeks under way on the day of admission, exhibited merely slight abdominal distention and slight rigidity of both recti muscles, but tenderness over the entire lower portion of the abdomen.

On incising extraperitoneally, a large amount of pus mixed with serum was evacuated, and 3 large abscesses were located and drained: one deep in the pelvis, another in the median line, and the third at the lower margin of the liver. As the appendix was bound in the abscess wall, it was not removed.

A man, whose second attack began two days before admission, revealed, on examination, general distention and tympany of the abdomen and board-like rigidity of both recti muscles. There was marked tenderness all over the right side of the abdomen, but especially over McBurney's point. The appendix was bound by plastic exudate to the cæcum, was 9 cm. long, thickened, swollen and congested, and the seat of two perforations. In places it was gangrenous. It was necessary to make a counter-incision in the right flank to permit of additional drainage.

The death occurred in a man whose case was very similar to that just cited, except that he was admitted four days after the beginning of his second attack. Examination revealed a leaky skin and evidences of general septic infection. The abdomen showed general distention and tympany, marked rigidity of both recti but greater on the right side, and general tenderness over the entire abdomen, most marked over the right iliac fossa.

Incision opened up a large retro-cæcal abscess in the vicinity of which the intestines were bound together in a plastic exudate, and elsewhere an extensive purulent peritonitis was present. The appendix was 7 cm. in length, retro-cæcal, gangrenous in its lower third, and perforated. So, too, as in the preceding case, a counter-incision was made in the right flank to obtain free drainage. The patient lingered five days after operation. Post mortem revealed an acute fibro-purulent peritonitis, focal gangrene of the cæcum and distal 15 cm. of the ileum, with parenchymatous degeneration of the liver and kidneys. These last two cases are almost identical in every respect, with the exception that one, the fatal one, was two days further advanced in his attack than the other, but *he died,* while the other recovered. This is another forceful and convincing illustration of the oft-repeated cry that *delay* is *fatal.* And it shows actually

the damage done to the organs by retention of highly toxic pus, which was spoken of above when estimating its effect on the kidney by clinical examination of the urine.

In 25 cases of *chronic appendicitis,* 10 were in males and 15 in females, with no deaths. The appendix was found chronically diseased and removed in 8 patients at the same time the condition for which the operation was performed was relieved; of these, 1 was a male and 7 were females. The time elapsing since the last attack varied from seven days to two years. In one case, that of a physician, the disease had existed for 12 years, until continual pain and soreness over the appendix when walking and after eating, which had existed since the last attack, a year previously, led him to seek relief. This same complaint was given by 8 of the 25 patients, bringing them to operation which almost invariably revealed adherent appendices. In 7 cases there was marked constipation, in 4 of which the appendices were bound down by adhesions. One patient, a female, suffered for a year with symptoms that simulated cholelithiasis, complaining of almost continual pain in the epigastrium, at times radiating to the right shoulder, frequent biliary vomiting after eating, and two distinct attacks of jaundice. Operation revealed a slender cord of omentum, 10 cm. long, between the otherwise normal gall-bladder and the chronically diseased appendix. The appendix of another woman contained 2 ascarides of the variety oxyuris vermicularis (thread worm). In a man the appendix was found anomalously placed on the ascending colon, 10 cm. above the cæcum. The other appendices were found to be thickened, kinked, congested, constricted or adherent. The lumina, usually patulous, at times were partially obliterated, or contained fæcal concretions.

The McBurney incision was made in 16 cases and in the remaining 9 the incision was carried through the right rectus muscle. The appendix was wholly extirpated by the method mentioned above in 12 cases: the stump was invaginated into the cæcum by means of a silk purse-string suture in 12 cases, and in the remaining case the organ was simply amputated,

and the stump cauterized owing to its difficult retrocæcal position. The abdominal layers were approximated with tier suture of chromicized catgut in all cases except one.

Carcinoma of the Appendix.—This was present in the case of a female, aged 23, whose appendiceal history had extended over a period of five years, in which there occurred three attacks. The appendix was kinked and curled about the cæcum, curved on itself, its lumen obliterated, and its proximal part congested and swollen. Microscopical examination revealed carcinoma.

THE STOMACH—*Pyloric Stenosis.*—There were 7 cases of pyloric stenosis, 5 benign and 2 malignant. The benign cases were all due to chronic gastric ulcer, and all recovered from the posterior gastrojejunostomy. There were 4 males, ages 15, 20, 25 and 53, and 1 female, age 57. All complained of chronic dyspepsia.

In addition to the thickening, induration, and cicatrization of the pyloruses, the stomachs were all markedly dilated. Five years previously the oldest male had undergone a pyloroplasty elsewhere; after a year's relief, aggravated symptoms returned. In the female, the gastric mucosa presented a markedly hæmorrhagic "weeping" appearance, and the second and third parts of the duodenum were congested. Note was made that one of these patients on discharge two weeks after operation, could eat solid food without discomfort, and had gained two pounds already during that time.

The 2 carcinomata were in males, ages 50 and 55. In both the fulminating dyspepsia symptoms—6 weeks' duration in the elder with the loss of 35 pounds, and 1 year in the younger with the loss of 30 pounds in the latter 4 months—were strictly in contrast to the chronicity of the benign cases. Posterior gastrojejunostomy relieved the elder of symptoms. The death occurred in the younger emaciated man, who in addition to the stenosis showed perigastric adhesions, secondary carcinoma of the head of the pancreas, and a distended gall-bladder. Pylorectomy, drainage of the gall-bladder, and posterior gastrojejunostomy were performed.

Cardiac Stenosis.—There was one case of cardiac stenosis in the person of a female, aged 43, who suffered ten months from symptoms due to gradual thickening of the cardia. Operation revealed a large, diffuse mass at the cardia, extending down over the greater curvature, and infiltrating the wall sufficiently to prohibit gastrostomy. Jejunostomy, however, gave relief.

Acute Gastric Ulcer.—This occurred in a woman aged 37 years, who six months previously had been treated in the medical wards, when at one time she vomited 2,000 cc. of bright red blood; she apparently recovered and was discharged cured. Three days before admission to the surgical ward she had a recurrence of hæmorrhage, vomiting 1,500 cc. of bright blood. On the day of admission she vomited 2,000 cc. bright blood, and two hours after admission 1,500 cc. of dark blood. The patient was extremely anæmic, suffered from air-hunger, thirst and had a rapid pulse. She was treated medically with the hope that her condition would improve and warrant operative interference later; as there was no evidence of improvement and the patient was becoming weaker, gradually declining, it was thought under the circumstances best to do a posterior gastroenterostomy. The patient did not survive long. The mucosa showed multiple ulcers and a hæmorrhagic or "weeping" state.

Liver and Gall Passages.—There were 8 cases of *cholelithiasis,* all females, in 4 of whom the gall-bladder was removed. Three had had enteric fever; in 1 this disease occurred four months previous to operation; chills in 1.

Jaundice occurred in 3 cases, biliary colic in all, biliary vomiting in 4, and nausea without vomiting in another.

Adhesions existed between the gall-bladder and transverse colon (1 case); liver margin, transverse colon and pylorus (1 case); omentum adherent to gall-bladder and liver (1 case); between omentum, transverse colon and gall-bladder (1 case); no adhesions 4 cases.

Calculi, from 2 to 500 were removed from the gall-bladders in all the cases, and from the cystic duct in 3; from the common duct in one case 4, and in another, 1.

Of the excised gall-bladders, 2 were greatly thickened, 1 was extensively diseased, and the fourth was the seat of

empyema. The four remaining gall-bladders were drained by rubber tube, from 20 to 300 cc. of bile of varying consistency being present. A rubber tube drained each of the 2 common ducts from which the gall-bladder and calculi had been removed. Strips of gauze and rubbed dam were used in 7 cases.

In a case in which the gall-bladder was ulcerated, 200 cc. of bile-stained pus were evacuated from an abscess below the gall-bladder. The omentum was stitched across the wound in the middle, thus separating the upper wound from the gall-bladder below.

A chronically inflamed appendix was removed from one case.

Biliary Fistula.—This was present in a male, aged 23, a sufferer from enteric fever five years previously, from whose gall-bladder 200 calculi had been removed elsewhere 18 months previously, this operation being followed by a biliary fistula, to close which an unsuccessful attempt was made 4 weeks after discharge. The fistula was obliterated by invaginating the edges of the gall-bladder; drainage, 1 piece of gauze.

Cholecystitis.—Six operations for cholecystitis were performed on 3 males and 3 females, one of the latter dying 7 weeks afterwards from a pronounced myocarditis. Two patients had had enteric fever. All had been jaundiced, all had cramps or pain in the right hypochondriac region, and one had chills. Adhesions were present in one between the gall-bladder, liver and duodenum, and in another between the gall-bladder and pylorus. In no case were calculi found, and all the ducts were patulous. Drainage in each case consisted of a rubber tube sutured in the gall-bladder, beneath which was placed a gauze strip, isolated by rubber dam.

A chronically inflamed appendix was removed from one case.

Pericholecystitis.—A female aged 40 had been relieved of 25 biliary calculi elsewhere, 10 years previously, and a year later similar attacks of biliary colic recurred. A month before admission the previous drainage site opened up, discharged three calculi, pus, bile later, and closed again. The attacks ceased, but discomfort persisted. Operation revealed extensive adhesions between the abdominal wall, omentum, gall-bladder and duo-

denum, but no calculi. The adhesions were separated and gauze drainage instituted.

Chronic Interstitial Pancreatitis.—This occurred in a man aged 55, a sufferer from indigestion with occasional severe vomiting for 21 years. Six years previously he had sudden epigastric pain and since then slight epigastric soreness had persisted, and increased a year before admission, since which time he has experienced progressive loss of strength and flesh, reducing from 200 to 166 pounds in the year's time. On admission he was emaciated and anæmic, with a firm mass in the epigastrium. Operation, consisting in gall-bladder drainage by a rubber tube aided by gauze in rubber dam adjoining the cholecystotomy, revealed a hard nodular pancreas, moderate hepatic cirrhosis, gall-bladder distended with bile but no calculi. Before operation the fæces exhibited free fat and bile pigment, but no undigested muscle fibres.

HERNIA.—*Inguinal.*—There were 8 operations, 6 males and 2 females. Of these herniæ, 2 were bilateral, 3 right and 3 left, and of the right two were irreducible, 1 being strangulated. Half these patients had worn trusses. Primary union followed the 10 Bassini operations.

In one patient, a woman aged 23, the right inguinal hernia was congenital, and perineorrhaphy was performed at the same time.

Umbilical.—This woman, aged 42, the mother of 7 children, had had the hernia 10 years in addition to a left inguinal hernia. At operation, the sac of the former was adherent, and contained omentum but no gut. The recti were overlapped.

Incisional.—These 2 herniæ, both in women, followed appendiceal abscess operations that required free drainage. One was of 6 and the other of 30 months' duration.

Fæcal Fistula.—There were two cases of fæcal fistula. One developed in a student 5 days after the repair of an incisional hernia elsewhere, which in turn 3 months previously had followed an operation for acute appendicitis 3 years ago. Operation revealed a fistula in the cæcum 2 x 3 cm., and this was sutured with silk, over which was sutured an epiploic appendage.

The other patient, a male, was also operated on elsewhere 9 months previously for appendiceal abscess, and developed 9

days later, intestinal obstruction, requiring re-operation. Four days after this second operation, a fæcal fistula developed at the incision of the first operation, in which a glass tube had been used. The second incision had been sewn up, and was already healed. Operation revealed a fistula in the cæcum 1 cm. from the ileocæcal valve. The opening was closed with silk, reinforced by an epiploic appendage. The congested, swollen and adherent appendix was removed and the stump retained in invagination by a silk purse-string suture.

URINARY ORGANS.—*Wandering Kidney.*—There were 5 cases, 1 in a male, 4 in females, all on the right side. One patient had suffered for 2 years since being thrown from a wagon, striking on her right side. This kidney, movable to the third degree, was sutured by a modified Edebohl's method.

The second case occurred in a single lady aged 43 who, 5 months previously, had experienced pain and sensation of discomfort in the right side after having lifted her invalid mother. Three months later the patient had an attack of acute appendicitis. At the operation the wandering kidney was anchored by a modified Edebohl's method, and the chronically inflamed appendix removed.

Another patient had complained for 3 years of pain below the right costal margin. The third degree kidney was hammocked with gauze.

Associated with pyonephrosis was a freely movable kidney in a female aged 36, that had existed 18 months. To the ordinary symptom of dull aching pain in the right side were added, a month before operation, frequent, painful and scalding urination. Examination revealed a movable tumor in the right loin space, excoriation of the external urethral orifice, and retroflexion of the uterus. The Israel incision revealed an enlarged, grayish, lustreless kidney, the pelvis and parenchyma of which were the seats of multiple abscesses. The kidney, with 10 cm. of the ureter, was extirpated.

The fifth patient had been operated on at different places for various abdominal conditions, 11 times during the previous 14 years. One of these operations, 9 years before admission, consisted in anchoring the right kidney with silver wire. The patient had an attack of Ditell's crisis 7 and another 4 months previous to operation which revealed a small cyst at the lower pole of the

wandering kidney. The cyst was evacuated, and the kidney hammocked in gauze.

Ureteral Calculus.—Two cases of ureteral calculi, both of whom were females who had suffered frequently from severe attacks of renal colic for 10 years. In each case the right kidney was involved and removed. Operation revealed in one a right wandering kidney, of which the pelvis was diseased and contained a calculus. In the other patient there was a small calculus situate one inch below the pelvis, and immediately beyond it the ureter for a distance of about one inch was the seat of a fibrous stricture; microscopic examination revealed chronic pyelitis with early malignant proliferation. Both patients recovered.

Vesical Calculus.—This man, aged 56, during the past 11 years had had numerous attacks of renal colic in the left lumbar region, radiating to the groin and genitals. He had passed a number of calculi, and at one time, 3. The last attack occurred three weeks previous to operation, the patient feeling the calculus passing to the bladder. During urination the stream would stop suddenly. The calculus was removed by suprapubic lithotomy, and the bladder drained by a rubber tube. The pre-operative cystitis from self-catheterization subsided, and the urine was normal on discharge 60 days after operation.

Dorsal Neuritis.—This patient, a woman aged 30, had been operated on elsewhere 2 years previously for right wandering kidney. Since the operation the patient had suffered from griping, dragging pain in the right lumbar region in any position she assumed. The pain radiated down over the right buttock. The diagnosis of chronic neuritis of the lateral cutaneous branch of the last dorsal nerve was made. At operation, after removing the scar, this nerve was dissected out and excised for a length of 5.5 cm. The patient was discharged, cured.

BREAST.—*Carcinoma of the Breast.*—There were 8 cases of mammary carcinoma, 1 in a male, and 7 in females. The right breast was affected in 6, the left in 2. Two of the women gave a family history of cancer, and 1 a history of trauma. Halsted's operation was performed in the 4 favorable, and simple removal of the breast in the 4 unfavorable cases.

The male patient, a tailor aged 48, had had a small lump in the right breast for 10 years. This caused no disturbance until

it began noticeably to grow 6 months before operation. Examination revealed a hard, irregular, non-encapsulated tumor the size of an egg, which was adherent and ulcerated. The nipple was retracted. Owing to his occupation, the breast alone was removed.

Uterus and Appendages.—*Uterine Fibroids.*—There were 7 cases of uterine fibroids, in 6 of which abdominal and in 1 vaginal hysterectomy was performed; in 4 patients, all past the menopause, the hysterectomies were complete. Of the 2 incomplete, in 1 there was added a left intra-ligamentary cyst and a chronically inflamed appendix; in the other, the diseased right tube and ovary were removed with the uterus. The vaginal hysterectomy was performed in a patient aged 63, with Pryor's clamps. The clinical diagnosis of fibroids were all confirmed by microscopical examination.

Carcinoma of the Uterus.—There were 6 cases of carcinoma of the uterus, 2 involving the cervix and 4 the body of the organ. Complete abdominal hysterectomy was done in 5 cases, and vaginal hysterectomy, using Pryor's clamps, in one case. The youngest patient was the case of vaginal hysterectomy for squamous epithelioma occurring in a Polish woman aged 26 years.

In addition to the above cases of hysterectomy for carcinoma there were 5 cases of complete abdominal hysterectomy for infected uteri; one of which was complicated by a papilliferous adenomatous cyst of the ovary and a chronic appendicitis; the appendix was also removed.

Retro-Displacements of the Uterus.—Retroversion was present in 4 cases, and was corrected in 1 by Alexander's extraperitoneal, and in 2 by Tuffier's intraperitoneal shortening of the round ligaments, in 1 of the latter both ovaries and the left tube being diseased and removed. In another Mann's operation was performed.

A prolapsed uterus of 2 years' standing caused by a lacera tion of the perineum, was corrected by ventro-suspension and perineorrhaphy.

Extra-Uterine Pregnancy.—This interesting condition occurred in 6 patients, whose ages ranged from 20 to 35. Of these, 3 were primiparæ, 2 had borne children 6 years previously, and 1 had had 3 miscarriages. Two patients experienced sudden, sharp, cutting pain in the pelvis, one of whom fainted. Five of

the 6 gestations were right-sided and ruptured, and the other unruptured on the left side. Five were tubal and 1 tubo-abdominal. Three of the patients were irrigated with saline solution and drained by a glass tube in the pelvis, 2 were not drained, and 1, in whom a large cyst was found on the opposite side, was drained with gauze.

Diseases of the Tubes and Ovaries.—There were 7 cases of pyosalpinx, 4 bilateral in one of which the appendix was involved; 1 right sided in which the appendix was involved, and 2 left sided. Of 3 cases of chronic right-sided salpingo-öophoritis, the appendix was involved in one; 2 other cases were on the left side. Both ovaries were cystic in 1 case, and the left in another. There were 2 cases of left-sided ovarian cyst, in 1 of which was a small dermoid.

In addition to those operations described above, the following less interesting were performed at the clinics:

Abortion (curettage)	1
Abscess, perichondrial (post-typhoidal)	1
Abscess, ischio-rectal	1
Abscess (peri-urethral)	1
Adenitis, axillary, tubercular	1
Adenitis, cervical	2
Adeno-fibroma, breast	1
Adhesions, abdominal	2
Arthritis, knee, tubercular (excision)	1
Arthritis, carpi, tubercular (amputation)	1
Atresia of cervix	1
Carcinoma of cæcum (resection, ileo-colostomy)	1
Carcinoma of sigmoid (ileo-sigmoidostomy)	1
Carcinoma of tongue (unilateral excision)	1
Cyst, suprahyoid	1
Cystotomy, suprapubic, for tuberculosis of bladder	1
Empyema	2
Endometritis (curettage)	3
Fissure-in-ano	5
Fistula-in-ano	1
Fracture of tibia and fibula, comp. and commin. (amputation)	1
Goitre, cystic (unilateral thyroidectomy)	1
Hæmorrhage, secondary following an abdominal section	1
Hæmorrhoids (clamp and cautery)	4
Hydrocele (radical)	3
Hypertrophy of cervix (amputation)	1
Lacerated cervix (trachelorrhaphy)	1

Lacerated perineum (Emmet)	3
Lipomata	2
Myxofibroma abdominal wall and ileum (enterectomy)	1
Neuralgia, tri-facial (neurectomy)	1
Retained secundines (curettage)	3
Sarcoma of back	1
Sarcoma of parotid (extirpation)	1
Stricture, urethral (dilation and perineal section)	4
Supernumerary toe	1
Ulcer of leg, traumatic (excision and curettage)	1
Urethral caruncle	1
Varicocele	2
Varicose veins of leg (phlebectomy)	2
Total	64

The deaths were: Acute appendicitis, 1; Carcinoma of cæcum, 1; Carcinoma of tongue, 1; Carcinoma of pylorus and pancreas, 1; Carcinoma of sigmoid, 1; Cholecystitis, 1; Empyema, 1; Tuberculosis of bladder, 1; Ulcer of stomach, 1.

GLANDERS IN THE HUMAN SUBJECT.

CLINICAL REPORT OF TWO CASES OBSERVED IN THE FOURTH MEDICAL DIVISION OF BELLEVUE HOSPITAL OF NEW YORK.

BY JAMES TAFT PILCHER, M.D.,

OF NEW YORK.

CASE I.—B. C., age 30, Russian, stableman, was admitted to Bellevue Hospital, December 31, 1905, with the following history:

Six weeks previous to admission he was bitten in the thigh by a horse, which at that time was apparently healthy and has remained so. Two weeks later a new horse was purchased, which was taken ill in a few days and was attended by patient; after a week the horse was shot by order of the Board of Health, having developed cutaneous nodules and many points of superficial ulcerations; diagnosis, glanders.

Three days previous to applying at hospital the man went to work feeling perfectly well. During the afternoon he was seized with sharp, stabbing pains in left chest, posteriorly, which increased on deep inspirations; shortly afterward he had a short, dry cough; sputum normal, moderate dyspnœa, and increasing pains in left side. These symptoms becoming more insistent, he presented himself at the hospital and, on examination, showed:

A well-developed and well-nourished male; apprehensive and flushed facies; rapid, shallow, grunting respiration; skin hot and dry; general appearance of one acutely ill.

Lungs: Over left lobe, dulness; absent, vocal fremitus; diminished breath sounds and many coarse, crepitant rales. Otherwise negative, especially pharynx, nose and skin.

Appended is record of bedside notes, made by the writer, which will indicate the progress of patient's illness more in detail.

December 21.—Patient admitted. Temperature 103; pulse 104; respiration 28; with considerable œdema of lungs; under active and continuous stimulation and radical use of vaso-constrictors, this condition was relieved.

December 22.—Looks very ill; more so than would be indi-

cated by his physical signs. Temperature 103; pulse 120; respiration 52. Acts apprehensively, and is resistive on being moved.

December 23.—Pulse and respiration continue rapid; temperature rising. Complains of a good deal of deep-seated pain, no external evidences. Lung signs unchanged.

December 24.—During past twenty-four hours has been semi-delirious, and so restless that restraint has been adopted.

December 25.—Prostration progressive. Right knee held flexed, and is painful to palpation; is slightly swollen.

December 27.—Patient seldom moves; seems to have generalized pains. Right knee joint more swollen; back of right hand and outer aspect of ankle tender to touch.

December 30.—Right knee markedly swollen. Right hand and left ankle reddened, painfully hot. Pain on pressure over extensor muscles of legs and flexors of both arms, particularly right.

January 2.—Multiple tumefactions appearing on thighs, arms and legs; condition of ankle, knee and hand progressively worse. General condition critical; temperature, pulse, respiration going up. Breathing shallow, with inspiratory and expiratory stertor; is in great pain; dyspnœa increasing and more difficult.

January 3.—Died 1 A.M. Seemingly septic.

(See Chart A.)

Clinical Pathology.—On admission, white blood corpuscles 14,700; following day, 14,700; December 29, 13,700; ante mortem, 19,500.

December 30.—Widal examinations with negative results.

December 31.—Blood culture, showed at end of forty-eight hours on blood agar plates, numerous deep and superficial colonies, about 35 to a plate; the superficial ones being raised, whitish, opaque and viscid. The flasks showed a flocculent sediment which, on examination, showed a small, slightly bent, irregularly stained, gram negative bacillus, strongly suggesting B. mallei. Sub-culture on potato showed, after a few days, a characteristic raised, viscid, brownish growth.

Post-mortem examination, made ten hours after death, by Dr. Pappenheimer, showed a moderately well-nourished male, about 35, of medium frame. Small, superficial abrasion covered by scab, no area of inflammation, on external surface of right thigh. Over both arms, on dorsum of right hand, over left thigh

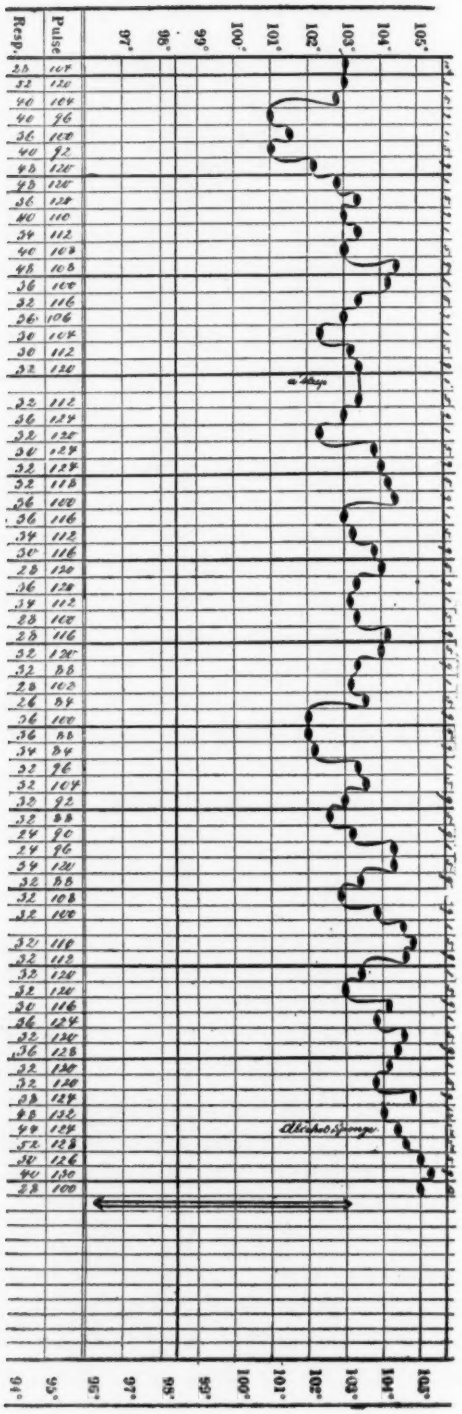

Chart A.

on external surface, and scattered irregularly over rest of body, are a number of deep-seated nodular swellings, showing as diffuse, rounded prominences of the skin, without external signs of inflammation. Section shows them to correspond to abscesses localized chiefly within the muscles and deeper layers of the corium. The abscesses contain a thick, yellowish white or brownish pus. There is apparently entire absence of inflammatory reaction about them, neither granulation tissue nor hyperæmia. Right knee swollen; on section, exudes thin, purulent fluid. Swelling over third right metacarpo-phalangeal joint; incision followed by escape of thin pus. Left lung adherent over the lower half of lower lobe to the chest wall. Right lung free.

Lungs.—Left lung: over lower portion of lower lobe, the pleura is thickened, showing patches of firmly adherent fibrin and superficial circular yellowish abscesses. Bronchial lymph nodes are small anthracotic, and the seats of calcareous deposits. Bronchi contain frothy fluid, otherwise normal. Parenchyma of the lung, save for moderate œdema, normal. Right lung shows moderate œdema.

Spleen.—Slightly enlarged, capsule tense. On section it is somewhat softer than normal; pale in color; no undue prominence of Malpighian bodies or trabeculæ.

Larynx.—Left aryteno-epiglottic fold and the mucous membrane in the pyriform fossa on the left side are markedly œdematous. There is a fine erosion of the left cord. The anterior wall of the larynx, just below the rima glottidis, shows a group of small submucous abscesses which exude thick, yellowish-white pus. These show no surrounding inflammatory reaction. M. M. of trachea elsewhere normal.

Stomach.—Shows numerous ecchymoses; slight swelling of the mucous membrane; in the pyloric half the mucous membrane is mammillonated; this condition is marked also in the first portion of the duodenum. The heart, liver, pancreas, adrenals, kidneys, bladder and ureters, pharynx, small and large intestines, thyroid and brain are negative to any essential gross changes.

Anatomical Diagnosis.—Pyæmia (glanders) and abscesses of muscles, pleuræ, and laryngeal mucous membranes.—Smears were made from the laryngeal abscesses and from several of the subcuraneous lesions. Cultures were made from the spleen and from the pus in a deep nodule in the right arm. A guinea pig was

injected intraperitoneally with a broth suspension of pus from a subcutaneous abscess. The B. mallei was obtained in pure culture from the spleen and abscess, and bacilli having characteristic morphology and staining reaction were seen in smears from the pus.

The guinea pig showed, after twenty-four hours, slight swelling of the testicles which, at the end of seventy-two hours was very marked, the overlying skin being hot and glazed. Three days after injection the pig was killed; autopsy showed superficial abscesses in the seminal vesicles, and intense fibrinopurulent inflammation of the tunica vaginalis which was studded with small miliary abscesses. The testes proper were swollen to about twice their normal size. There was no peritonitis. Pure cultures of B. mallei were obtained in streak plates on glycerine agar from the peritoneal cavity and the tunica vaginalis.

CASE II.—H. M., age 55, stableman. Patient was admitted to Bellevue Hospital, April 4, 1905, in a delirious condition. No history was obtainable other than that he had been bitten on the top of the head about a week previously, and that for the last few days before admission his right arm and shoulder had become painful and swollen, and that he had become feverish and weak.

On examination, a well-developed and well-nourished male presented himself, apparently acutely ill; skin hot and dry, capillary ectasia over both cheeks and nose, ecchymosis under right eye. Spastic condition of right arm which, together with right shoulder, was greatly reddened, œdematous and very tender. On vertex of cranial vault is a small scalp wound about which the skin extending out in all directions is swollen, red, indurated and œdematous; the edges are irregular and separated from the healthy tissue by an abrupt stump edge. Further examination is negative other than the signs of a moderate bronchitis, and a generalized neuritis, pain on pressure being especially marked.

On April 7, forty-eight hours before death, a generalized pustular eruption was noticed, particularly over forehead, face, neck and right forearm. These foci showed only in a very few instances, as was noted also in Case I, the purplish hyperæmic areola about them, which is supposed to be so characteristic of the infection of glanders. Smears were immediately taken from the pus, and showed bacilli having characteristic morphology and staining reaction of the B. mallei. A guinea pig was injected

intraperitoneally, and showed the successive phenomena typical of this infection in these animals, as was described under Case I. Clinically, the patient simulated the condition of the first patient. The temperature, pulse and respiration ran along in the same ratio and degree. His leukocytes, on day after admission, were 10,000; red corpuscles 5,000,000; hæmoglobin 90 per cent. and differential; neutrophiles 80 per cent.; mononuclears 4 per cent.; lymphocytes 16 per cent.; eosinophiles 0. Urinary examination in both showed a fairly typical degree of acute toxic nephritis.

(See Chart B.)

Post mortem, done a few hours after death, showed on scalp over parietal and anterior occipital region a central defect covered with dried scab; around this an area four inches across with numerous prominent, yellowish foci, one-third mm. in size.

Over forehead are noted elevations, 1 mm. to 1 cm. in diameter, some with yellow head, and others open over the dome of the prominence. One on right eyelid, one on left cheek, several on neck and supraclavicular region; a large one 2 inches in diameter over lower end of sternum, fluctuating at centre, yellowish, surrounded by red zone; on incision, brownish, thick pus.

On sides of abdomen were small nodules; right forearm, abscess in muscle; on inner surface right thigh, also nodule of same type as in forearm.

Under area of abscess described on lower end of sternum the bone shows yellowish infiltration of cancellous tissue; mediastinum shows quantity of yellowish-brown pus.

Head.—On section of scalp through area above described, the foci of suppuration are seen to extend down to the pericranium; the cellular tissue of the scalp, which is the seat of multiple abscesses, is œdematous; over the frontal bones just superficial to the pericranium are several groups of small, yellowish foci, each surrounded by a hyperæmic zone; calvarium normal.

Heart.—A few ecchymoses on pericardium, especially over left ventricle; muscle dark red.

Lungs.—Right apex adherent by old adhesions. On section, are seen numerous pustular foci, up to 3 cm., which on their pleural surface show yellowish centres with numerous smaller yellowish, pustular foci surrounding them, bounded by a hyperæmic zone; left presents the same lesions.

Tonsils enlarged to two-thirds cm.; œsophagus normal. On

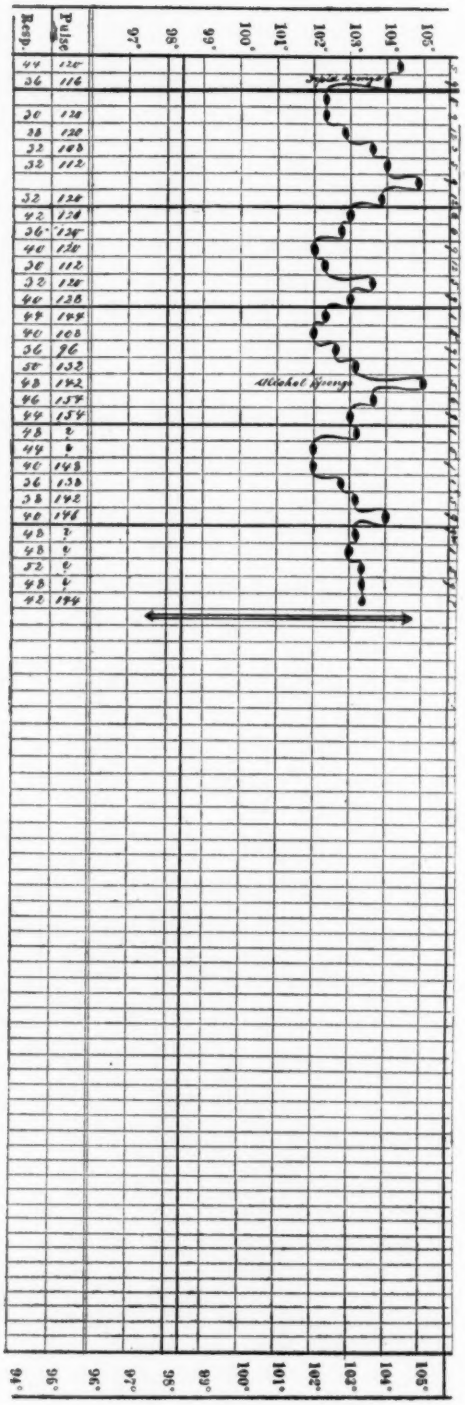
Resp.
Pulse
97°
98°
99°
100°
101°
102°
103°
104°
105°
Alcohol given
44 120
36 116
30 128
38 120
32 108
32 112
32 128
42 128
36 124
40 120
30 112
32 128
40 128
44 144
40 108
36 96
38 132
48 142
46 134
44 134
48 ?
44 ?
40 148
36 138
38 142
40 146
48 ?
48 ?
52 ?
48 ?
42 144

CHART B.

posterior wall of pharynx, on ary-epiglottic fold, in pyriform fossa, on epiglottis, farcy buds up to 6 mm. in diameter. Tracheal and bronchial mucosæ normal.

Spleen.—Shows moderate degree of septic softening.

Stomach.—Mucosa is ecchymotic.

Kidneys.—Lesions of acute parachymatous nephritis.

Intestines.—Mucosa congested.

Other viscera negative to gross changes.

REMARKS.

Beyond question the infection in Case I occurred through inhalation. In Case II inoculation through the scalp wound was the probable cause. However, though infection occurred differently in both cases, the ultimate symptomatology and clinical findings show a marked similarity. In Case I the incubation period was 25 days; course before fatal termination, 13 days. In Case II the incubation was only 5 days, while the course before death was only 9 days, showing a variability in the length of time elapsing between infection and exhibition of symptoms, due, it may be inferred, to the mode of infection in conjunction with the virulence of the infecting organism.

In both cases the striking thing is the fact that the degree of prostration is greatly out of proportion to the physical signs; in both there were the signs of a diffuse bronchitis, more marked in the first case. Both cases exhibited the signs early of muscular pains, probably caused by the early formation of deep abscesses. The most striking phenomenon is the early involvement of the various larger joints of the body.

There seems to have been no exhibition of lymphatic involvement. The glandular nodules or pustules, in both cases, became a terminal development. The historical bluish-red areola about the cutaneous nodules was lacking in both cases, Clinically, is noticed the sustained temperature curve and the disproportion between the temperature, respiration and the pulse, the latter being, in both cases, much lower during the majority of the course than would be accounted for by the extreme degree of temperature and the acceleration of respira-

tion, the latter tending to make one infer that the disease involved the respiratory apparatus.

Clinically, the most noteworthy phenomenon is the relatively low leukocyte count, in the first case varying from 14,700 to 13,700 per cm., with an ante-mortem rise to 19,500 per cm. In the second case, at the very height of the disease, the count was but 10,000 per cm., while the differential count does not show any particular inflammatory reaction; which observations, in themselves, taken together with the extreme grade of obviously septic involvement, would tend to make one suspicious of the infecting agent immediately.

Fresh blood preparations allowed to coagulate, the supernatant serum being removed, tests similar in execution and technique to the familiar Widal reaction are found, in the case of the B. mallei, to cause a similar agglutinative reaction.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, December 12, 1906.

The President, Dr. GEORGE WOOLSEY, in the Chair.

SUPPURATIVE SYNOVITIS OF THE KNEE.

DR. CHARLES H. PECK presented a man who had been subjected to a transverse incision into the knee joint for the relief of suppurative infection. The case is reported in detail in the paper on page 409.

DR. JOHN A. HARTWELL presented a man, forty-eight years old, who was admitted to the Lincoln Hospital in May, 1903, suffering from an injury to the right leg, a heavy box having fallen directly across it. Examination showed a fracture of the tibia just below the head of the bone and a severe contusion of the joint itself. In the course of a few days the knee joint showed evidences of infection, with the usual septic symptoms. The infection was possibly due to the fact that the joint had been aspirated in order to relieve the tension.

As the septic symptoms increased in severity, a transverse incision was made across the joint, and the patella turned upwards. The ligaments, however, were not divided, as Dr. Peck had done in his case, and it was perhaps owing to that fact that the outcome of the case was not more favorable. In spite of the free exposure of the joint and thorough irrigations twice daily, with the knee flexed and the patellar flap drawn well upward, the case ran a very septic course, which continued for five or six weeks. The fracture of the tibia was a complication which rendered the treatment more difficult. The patient suffered much pain. Several ineffectual attempts were made to suture the patella back into

position, but each time the recurrence of the suppurative process underneath the bone would interfere with its reposition.

Ultimately the crucial ligaments and most of the lateral ligaments sloughed away so that a backward dislocation of the knee took place. Dr. Hartwell was inclined to think that a better result would have been obtained if the joint had been opened by free lateral incisions placed as far posteriorly as possible.

As a result of the injury and the prolonged suppurative process, the patient now had a stiff joint, with a good deal of deformity, but this did not interfere with his occupation as a shoemaker, and he was well satisfied that the limb was not sacrificed.

DEFORMITY OF THE SHOULDER JOINT.

DR. HARTWELL, through the kindness of Dr. A. S. Vosburgh, presented a girl of twelve, who three years ago was successfully treated by Dr. Lorenz of Vienna for a congenital dislocation of the hip. About a year later she awoke one morning, complaining of a disability of the right shoulder. There was no history of a fall or injury, and the function of the joint prior to that time had apparently been normal, although the child's parents had noticed that she usually slept on the right side, with the shoulder deeply burrowed in the mattress.

Since the onset of the trouble, two years ago, the disability of the joint had steadily increased. At the present time the acromion was very prominent, and there was distinct atrophy of the deltoid muscle. There was no reaction of degeneration in the muscle, and a certain amount of power still remained. There was practically no motion in the shoulder between the humerus and scapula. There had never been any pain. The shaft of the humerus was apparently normal, but the head of the bone seemed to be out of position. The humerus was nearly an inch shorter than on the normal side.

Dr. Hartwell said the patient had been examined by a number of surgeons and orthopædists, and various views had been expressed as to the nature of the condition. Some regarded it as a dislocation, others as a fracture of the anatomical neck of the humerus.

In connection with this case, Dr. Hartwell showed a radiograph of the shoulder taken by Dr. Wisner R. Townsend in February, 1906, and one taken at Bellevue Hospital in December,

1906. Dr. Hartwell had diagnosed tuberculosis of the humerus and advised operation, but this was refused because of the conflicting opinions which had been expressed by the different surgeons who had seen the joint.

Dr. Royal Whitman did not think there were any evidences of a fracture. He regarded the case as the result of disease, the head of the bone having been destroyed by granulation tissue, "caries sicca." The process was probably of several years' duration. Cases of this character in which the progress in limitation of motion, stiffness, pain and resulting atrophy did not attract especial attention for a long time were not at all uncommon.

Dr. V. P. Gibney said he was inclined to agree with Dr. Whitman that the case was one of tubercular osteitis of the shoulder joint, probably having its origin in early life. These cases, the speaker said, frequently went unrecognized until several years after the onset of the disease. In reply to a question as to the most favorable method of treatment, Dr. Gibney said he would suggest an arthroplasty, which might increase the range of motion. The operation was comparatively new, consisting of removing through long incisions the contractured tissue such as capsule and new bands followed by the interposition of fascia covered with fat, taking from the muscles, covering the bone eroded of cartilage with this fatty tissue—the object of which clearly was to prevent subsequent synostosis.

Dr. Hartwell, in closing, said he had been inclined to regard the case as one of tubercular disease of the shoulder, but there had been so many conflicting opinions that he had deemed it advisable to present the case for diagnosis.

STATUS OF A CASE FOUR MONTHS AFTER RIGHT NEPHROSTOMY.

Dr. F. Tilden Brown presented an unmarried woman, forty-eight years old, who for two years had suffered from hæmaturia. She was first seen by Dr. Brown with Dr. Galbraith on July 15, 1906, at which time cystoscopy showed a bleeding neoplasm the size of a large hen's egg.

After the patient's admission to the Presbyterian Hospital, on July 20, three weeks were devoted to local and constitutional treatment in order to fit her for an operation, but her anæmia and

emaciation increased. The hæmaturia, foul cystitis and general sepsis were but slightly improved, her temperature frequently going up to 105. There was a tumor of the bladder which involved enough of the right vesical wall and the vesical portion of the right ureter to require such an amount of cystectomy as would cripple the corresponding kidney unless its damaged outlet was compensated for in some way. For this reason, lumbar drainage seemed better than ureteric transplantation to some other portion of the bladder, because a recurrence of the neoplasm might demand a subsequent and more extensive cystectomy. Consequently, on August 11, a right nephrostomy was done, which comprised placing two chromic ligatures on the ureter, an inch or so below the renal pelvis, and severing it between them; then making a punctured opening for a soft rubber angled catheter from the convex surface of the kidney into its pelvis. To do this in a normal kidney in which the pelvis was of course a small collapsed space, was attended with considerable difficulty and uncertainty unless the finger was called into requisition; needless to say, the finger was disadvantageously large. For this purpose, the proper resource was a probe to be passed into the proximal end of the severed ureter, and advanced through pelvis, calyx, parenchyma and capsule; then the probe tip was to be seized by dilating forceps, which were led back into the pelvis as the probe was withdrawn. Now, withdrawal of the partly opened forceps would afford a safe and adequate tunnel for the catheter.

After the drainage catheter was adjusted in the kidney, the fibrous and fatty capsule immediately surrounding the catheter were united to the wound opening in the upper angle of the lumbar fascia, for the purpose of coupling the parts and maintaining the future sinus in as direct a line as possible to the surface; the catheter was secured in place also by a silk suture to the skin.

By September 4 the conditions connected with the nephrostomy were satisfactory enough to justify operation for the bladder tumor, although the patient was in much the same septic and debilitated state, due to the putrid cystitis and the bleeding from the necrotic tumor.

With the patient in partial Trendelenburg posture, a suprapubic cystotomy was done, which disclosed a soft tumor, two

inches in diameter, with adherent blood clot and necrotic filaments. Its pedicle involved the bladder wall for an inch or more, and was in touch with and just below and behind the right ureteral mouth. To secure space for dealing with the bladder wall, the tumor was ligated as closely as possible, and cut away. An elliptical section of the bladder wall was made well beyond the margin of the pedicle; this, as had been anticipated, involved the intra-muscular portion of the ureter. The wound was approximated by chromic sutures in layers. The intravesical part of the operation, particularly the suturing, was materially facilitated by having the bladder floor lifted well up by an assistant's finger in the rectum, and by the illumination afforded by a small cold electric lamp passed through the urethra and held just clear of the internal meatus. Before closing the bladder wound of entrance, a soft rubber two-eyed catheter, led through the urethra, was secured in the most favorable position. The parietal wound was closed in the greater part, space being left for wick drainage of the perineal space.

After the operation, convalescence was very slow but nearly constantly progressive. On October 31, 1906, the patient was discharged practically well, and already quite competent to care for the lumbar drainage catheter and the glass urinal suspended at the waist, into which the catheter led the urine from the right kidney. There was no wetting of her clothes or body day or night. She removed the catheter daily for boiling. At the time the patient was shown by Dr. Brown, the urinal contained about two ounces of clear urine. She had regained her lost weight. She had just menstruated for the first time in six months and was able to perform all her duties as a housemaid.

In referring to the drainage tube in the kidney, Dr. Brown said it should be a right-angled soft rubber, two-eyed catheter, of from No. 18 to No. 22, French size. The short arm of the catheter was just long enough to reach from the skin margin of the fistula to the centre of the renal pelvis. This distance would vary in different individuals. A catheter of the exact size could be specially moulded at slight cost. The ordinary straight catheter would not be satisfactory for several reasons, one being that the pressure of the clothing would give it such a sharp angling or bend as to occlude its lumen.

Dr. Charles L. Gibson suggested that the woman's con-

dition might be made more bearable by removing the kidney. Anything, he thought, was preferable to this method of draining the kidney externally.

Dr. Brown, in reply to Dr. Gibson, said he did not see that enough would be gained by removing the kidney to justify it. The sole advantage would be to save the patient the trouble of caring for her catheter and wearing a urinal, especially in view of the even remote possibility of a nephritis developing on the opposite side. It was preferable, he thought, to have two sound kidneys, even with one of them draining into the loin than to have but a single sound kidney. Experience seemed to show that by this external method of drainage, the kidney was not exposed to the same danger of infection as it was when the ureter was sutured into abnormal positions.

In reply to the query as to whether there was much danger of the kidney becoming septic, Dr. Brown said there was less danger of this by the external method of drainage than there was when the ureter was transplanted into the bowel. Of course, the transplantation of the ureter into another section of the bladder was the ideal operation, but it was more theoretical than practical. Stricture formation, cystitis and disturbances of the urinary function were not infrequent complications of such successful anastomoses; moreover, the immediate risks that attended the success of implantation itself were not inconsiderable.

Dr Brown said he was interested in the ultimate outcome of the kidney drainage in this case. While the presence of the catheter in the pelvis of the kidney was doubtless a source of more or less irritation and chronic pyelitis, it had thus far in this case given no evidences of that fact. The smooth and perfect condition of the eye-end of the catheter is of importance in guarding against this possibility.

Dr. Charles H. Peck said that he had recently seen a case where he had been obliged to resort to permanent lumbar drainage of the kidney as a life-saving measure. The patient was a woman who some time after a nephrectomy had an attack of complete urinary obstruction on the opposite side. A nephrotomy was done, and about 750 cc. of turbid urine withdrawn from the pelvis. The condition of the patient was such that a prolonged operation was not deemed advisable at the time, but it was concluded that the obstruction to the outflow of urine was due to a

kink in the ureter. After this operation, a ureteral catheter was introduced, through which there was free drainage, in addition to the lumbar drainage, but when the ureteral catheter was withdrawn five days later, no urine passed spontaneously. The quality of the urine drained through the loin gradually improved, and then the question came up of re-establishing the patency of the ureter. A ureteral catheter was again introduced, with a similar result. The kidney was again exposed with considerable difficulty, on account of the adhesions left by the previous operation, and a kink in the ureter was found near the junction of the ureter and pelvis. It was impossible to correct this, and a plastic operation on the ureter similar in plan to the Finney pyloroplasty was performed. While apparently satisfactory at the time of operation, the result proved unsuccessful. Permanent lumbar drainage was then resorted to as the last expedient. The operation was done on October 1, 1906, and when Dr. Peck last saw the patient, four weeks ago, the condition of the kidney was fairly good. He asked Dr. Brown whether permanent lumbar drainage of the kidney was compatible with prolonged life?

Dr. Brown said he could not answer Dr. Peck's question from personal experience. Dr. Watson of Boston had reported a case of double nephrostomy in a patient upon whom the operation was done eight or nine years ago, and who was still able to carry on the functions of an active business life without his associates even suspecting that he was wearing lumbar drains and urinals. According to Dr. Watson, these lumbar fistulæ showed no tendency to close. In fact, such would be impossible since the patency and even the continuity of the ureter was purposely sacrificed at the nephrostomy operation. In his own case, Dr. Brown said, the patient had gained many pounds in weight since the operation. She was a mere skeleton when she entered the hospital, and did not offer a very hopeful prospect of bearing a serious operation. Her menstrual periods, which had been in abeyance for eight or nine months prior to the operation, had returned. The speaker said that if he had known beforehand that a favorable report on the nature of the bladder growth would have been rendered by the pathologist, he would have been inclined to do a less radical operation, and would have limited himself to removing the tumor and leaving the bladder wall intact. Of course, the preliminary nephrostomy would not have been done.

Dr. Woolsey said that in one case of accidental division of the ureter he had had very good success follow the implantation of the ureter into the bladder. The operation did not seen to be attended by any great degree of risk.

RENAL HÆMATURIA: NEPHRECTOMY.

Dr. F. Tilden Brown presented a married woman, forty-seven years old, who came under observation on September 24, 1906, complaining of hæmaturia and right lumbar pain. Her father died of heart trouble. Her mother had long suffered from rheumatism. Two sisters died of pulmonary tuberculosis and the patient had a son who was suffering from that disease.

Personal History.—The patient had typhoid fever 19 years ago, and two years ago she gave an indefinite history of pneumonia. She had long suffered from severe, intractable headaches, and for many years she had had "stomach trouble," with vomiting after meals. She also complained of pains in the right lower abdomen and lumbar region on both sides, radiating along the thighs to the knees. These pains were of an indefinite character and so severe that they would often confine her to bed in the morning, abating in the afternoon. The pains were aggravated by riding on a street car, and were usually eased when in a sitting position by crossing the right leg over the left knee.

Some months ago the patient had an unusually severe attack of this pain, which kept her in bed for two weeks. There was no history of chills or fever. There was urinary frequency at times, and pain at the beginning of the act. In July, 1906, she had a severe attack of diarrhœa and cramps, and during the summer she lost considerable weight. There was no history of jaundice nor dropsy.

Nine days before coming under observation the patient first noticed that there was blood in the urine. This was subsequently verified by passing the urine into a glass. No clots were noticed. That evening she had a violent attack of vomiting and pain in the right lumbar region, high up, and radiating down the side toward the groin and across the back. Since then, every passage of urine had been bloody. There had been only slight frequency and pain on urination. The hæmaturia was not influenced by rest or posture. There had been frequent recurrence of the vomiting.

The patient was admitted to the Presbyterian Hospital on

September 28, 1906. Physical examination showed a well-nourished woman. She was slightly anæmic, but did not look very ill. Her chief symptoms were hæmaturia, and pain in the right lumbar region. An examination of the abdomen was practically negative, although upon bimanual palpation there was an indistinct sense of a mass in the right flank, which descended from beneath the costal arch on deep inspiration. The character of this mass could not be made out.

An examination of the separate urines showed bloody urine from the right ureter, while that from the opposite kidney was practically normal. Cultures made from the urines of both kidneys remained sterile. An X-ray examination gave negative results.

The case was regarded as one of hæmaturia of undetermined origin, and on October 1, 1906, the right kidney was exposed. The kidney was of normal size, and in fairly good position. The surface of the kidney was somewhat lobulated, and disclosed three reddish areas which were slightly raised above the level of the surrounding kidney tissue. Dr. George A. Tuttle, the pathologist of the hospital, thought they were infarcts, although not typical of that condition. The kidney, as well as the pelvis and ureter were thoroughly explored, with negative results. Although no calculus nor other abnormality was found to explain the hæmaturia, removal of the kidney was deemed essential, and this was done after opening the peritoneum and examining the adjacent abdominal organs. These showed no abnormalities.

The woman made a rapid recovery after the operation, and left the hospital on October 27. There had been no recurrence of the hæmaturia. The pathological report of the excised kidney had not yet been satisfactorily completed.

TRANSVERSE INCISION OF THE KNEE JOINT FOR DRAINAGE IN SEVERE INFECTIONS.

Dr. Charles H. Peck read a paper with the above title, for which see page 409.

Dr. Robert F. Weir said that in the two cases observed by him comparatively recently, which were referred to by Dr. Peck, and in which he had confined himself to the repair of the damage done to the joint by the disease and by the surgical efforts required to control the ensuing sepsis, his attention had been strongly

attracted by the difficulties that were encountered in bringing about a proper ambulatory support. So far as he then knew, only a resection of the joint along ordinary lines would answer, but this was not an easy matter in a child, where one is limited to the removal of quite a narrow margin of bone in avoiding the epiphyseal line, while the sub-luxation and the contracted tendons demanded a considerable space for the proper apposition of the denuded bone surfaces. Moreover, the turned-up flap of the patella and its coverings will not readily come down, and the replacement of the flap is only to be effected by taking out the patella and freely loosening the adjacent skin from its subjacent attachments. However, Dr. Lilienthal's method of removing the patella and splitting the flap at the time of employing the drainage might possibly do away with that difficulty.

Dr. Weir said that on referring to the original report of this method of drainage by Dr. Charles H. Mayo, he found that he simply cut freely through the patella, and thereby widely opened the joint, which was irrigated and packed with gauze, and the limb fixed on a splint. Subsequently, an article on this subject was published by Dr. William J. Mayo, in which he advised the transverse incision to go lower down, so as to divide the patellar ligament. No statement was made, however, about dividing the lateral or crucial ligaments, and nothing was said in regard to elevating the patellar flap. In that article, however, Dr. Mayo stated that he re-sutured the divided patellar ligament at the end of several weeks, and that particularly in children he was able in a number of instances to regain motion in the joint amounting to from 15 to 65 degrees of the normal range. To assure himself on these points in the surgical technique, Dr. Weir said, he had recently put himself into communication with C. H. Mayo, and had learned from him that his inferences were correct. Dr. Mayo had informed him that the crucial ligaments were not divided; that he only divided the capsule and the patellar ligament over the anterior half of the joint, and that the patella was not sutured.

If such authorities as these. Dr. Weir said, could get such good results and such a desirable degree of motion with a minimum amount of surgical damage, was it not possible that some of Mayo's willing followers had out-Heroded Herod and violated Talleyrand's injunction of showing too much zeal in dealing with these cases.

In concluding his remarks, Dr. Weir said it seemed to him that the following deductions were justifiable:

(1) That as the simpler, large double lateral openings of the joint (*i.e.*, running up to the top level of the capsule) would suffice for packing and drainage in the majority of cases, that method should be the one first tried in dealing with a suppurative arthritis.

(2) That if more radical efforts were required, the Mayo method should be resorted to, *i.e.*, transverse section of the anterior half of the joint, with irrigation and packing, together with flexion (not to an extreme point) of the limb on a splint, conjoined, in special cases, with popliteal drainage.

(3) In rebellious or progressively septic cases, endangering life, a wide open (utterly destroyed) joint, with uplifted patellar flap and extreme flexion, should be resorted to. Here the crucial and lateral ligaments should be divided.

In the first and second instances, there would be some hope of a more or less useful joint. In the last, only resection or amputation could be the outcome, if life was saved. Furthermore, in opening an acutely suppurating joint it is suggested that the flap method be reversed and the incision starting from a point a little below the articular line and in front of the lateral ligament should run across the joint at the top level of the capsule and terminate at a corresponding point on the other side of the articulation. This flap would open up best the area hardest to drain and if necessary, beside the irrigation and packing that follows the incision, it can be deflected with more ease than the one of Mayo and, better still, be more readily replaced by reason of its thinner base. It would permit likewise the coincident or subsequent division of the ligaments if this should be desired.

Dr. George E. Brewer said he had had four cases of septic infection of the knee joint, three of which were referred to by Dr. Peck. In at least one of those cases there was a very severe grade of infection, and he did what had been spoken of as the typical Mayo operation. He removed the crucial ligaments, but did not turn back the flap. The patient improved somewhat, but in spite of posterior drainage the suppuration persisted much longer than in those cases where he opened the joint more widely. Dr. Brewer said that if this case had been operated on earlier, the measures that were resorted to might have sufficed.

In a case which he showed at a meeting of this Society two or three years ago, the patient, while drunk, had fallen against a rock, and sustained a ragged, contused wound involving the knee joint. Simple drainage was tried for a day or two, but the infective process was so virulent and extended so rapidly that a radical operation was done. After four or five weeks the suppurative process came to an end without the formation of any secondary abscesses. A resection was then done, and after bringing the two cut surfaces into apposition, the skin was united loosely over the wound and a wet dressing applied. The wound healed by granulation and further recovery was uneventful.

Dr. V. P. Gibney said he recalled one case of acute infection, secondary to tuberculosis of the knee joint, where he opened the joint by a transverse incision. In spite of this the suppurative process persisted, and amputation became necessary as a life-saving measure. The Mayo operation, the speaker said, had not appealed to him in the class of cases that came under his observation. He rarely saw cases of acute suppurative arthritis in adults or adolescents. He occasionally met with the condition in infants, and in those cases he usually found that prompt incision, freely opening the joint, gave very satisfactory results, sometimes with resoration of function.

Dr. Royal Whitman asked Dr. Peck if he had had any experience in the treatment of secondary infection of tuberculous knee joints by this method? The speaker said he had found those cases very difficult to drain. The tissues of the joint, as a rule, were thickened and spongy, and while the immediate results of this radical operation were usually good, the exuberant granulations soon filled the wound and destroyed the exposed area. These became infiltrated with pus, so that drainage might be worse than before.

Dr. George D. Stewart said he recalled several cases in which he had operated on the knee joint somewhat after the manner described by Dr. Peck. The first case, which he saw several years ago, was one of severe infection of the joint in a child. It was operated on by the so-called Mayo method, but the result was not very satisfactory, and a resection was ultimately necessary.

The second case was that of a penetrating wound of the knee joint in an adult. Suppuration occurred, and after pro-

longed drainage had proved unsatisfactory, the joint was widely opened, the crucial and lateral ligaments divided, leaving nothing but the ligament of Winslow. The wound was irrigated and packed, and subsequently the joint was resected and the skin sutured loosely, after the manner described by Dr. Brewer. The patient made a good recovery, with a useful limb.

In speaking of popliteal drainage of the knee joint, Dr. Stewart said that he had never found it effective, so far as his experience went, even in the milder forms of infection. The muscles always drew the bones backward, and shut off drainage. In such cases, by flexing the knee slightly, access could be secured to the posterior pockets by going under either lateral ligament. A tube introduced in this way would not be compressed by the bone and would drain fairly well. Ideal drainage of this joint he did not believe possible.

The third case was one which Dr. Stewart, just before leaving on his vacation, turned over to a colleague for operation. The joint was widely opened and packed and when Dr. Stewart next saw the patient, about six weeks later, granulations had sprung up everywhere except over the articular cartilages; these, remaining, made it impossible to straighten the limb and delayed the progress of the case. Because of this and the increasing posterior displacement it was necessary to excise the joint practically after the method described by Dr. Peck; the result was prompt and satisfactory. Because of the delay occasioned by the articular cartilages, Dr. Stewart believes it best in any of these operations to remove the cartilages after the acute infection has subsided.

Dr. Woolsey said that after seeing a case of this kind which was shown by Dr. Gerster some ten years ago, he had been induced to resort to the procedure in two or three instances. One of them was particularly interesting, as the infection of the knee joint followed a fracture of the patella which had been sutured subcutaneously. Coincident with the infection, there was necrosis of the patella. Lateral openings were first made, but as these proved insufficient, a joint flap was made and turned back. The crucial ligaments were not divided. The result was fairly satisfactory.

Dr. Peck, in closing, said he had never applied this method to tubercular joints, nor had he seen it applied in such cases. He

was inclined to agree with Dr. Whitman that in dealing with tubercular infections of the joint, the method would not possess the value that it had in suppurative cases.

In regard to the method in general, Dr. Peck thought that the cases of knee-joint infection could be divided into three classes: First, that large proportion of cases which could be controlled by lateral incision and drainage. According to the figures given by Flint, from 70 to 80 per cent. recovered by that method with a fair amount of motion. Second, the typical procedure of Mayo was indicated in a certain proportion of cases, more particularly, it seemed to the speaker, in children, in whom the reparative processes were comparatively active. Third, in cases similar to his own, or to those reported by Drs. Brewer and Stewart, where the process was destructive or the infection was of a very virulent type, the proper operation was the complete one, with division of the crucial ligaments and eversion of the flap, thus completely exposing the posterior recesses of the joint. The latter were capable of containing a great deal of pus and of seriously interfering with complete drainage unless the crucial ligaments were divided. Popliteal drainage might answer the purpose in some cases, while in others lateral drains inserted under the lateral ligaments might prove satisfactory without division of the crucial ligaments, but in most of the severe cases the complete operation was demanded, and it should only be done as a preliminary to resection.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 3, 1906.

The Vice-President, Dr. Robert G. LeConte, in the Chair.

SUBPHRENIC ABSCESS FOLLOWING APPENDICITIS.

Dr. John H. Jopson presented a man who had walked into the Presbyterian Hospital, three months previousiy, suffering from acute appendicitis. Operation was performed at once and revealed a generalized peritoneal inflammation with much free pus and a perforated and gangrenous appendix. The appendix was removed and the abdominal cavity freely drained, the patient treated by a modified Murphy treatment,—that is, frequent rectal injections of salt solution and the exaggerated Fowler position. The condition of the man after the first day or two caused no anxiety until several days later when a persistence of temperature of 100° to 102°, without apparent cause, attracted attention. The wound was explored, without revealing a pocket of pus and there was no pelvic collection. Finally, dulness could be demonstrated posteriorly over the lower portion of the right chest, but all other signs typical of a subphrenic collection were lacking. There appeared no other cause for the symptoms, but the man was not physically depressed, and Dr. Jopson was loath to believe that subphrenic abscess was present. At the end of two weeks the chest was tapped without obtaining any fluid. The fever continued and after persisting for four weeks it was decided that there must be a subphrenic abscess. Dr. W. E. Hughes, who also saw the patient at this time, gave as his opinion that there was pus somewhere between the upper surface of the liver and the lower portion of the lung. Before operation could be performed

the patient expectorated a large quantity of foul pus, the temperature rose to 104°, respiration and pulse became more rapid and the patient showed evidences of shock and sepsis. There evidently had been rupture into the lung. Dr. Jopson thought the pus had first gone into the general pleural cavity. He decided on account of the shocked condition of the patient to wait 24 hours before operating, but again aspirated, this time in the tenth interspace posteriorly, and obtained several ounces of fetid pus. He intended operating the next day but the patient suddenly became worse, with dyspnœa and very rapid pulse, there evidently being an acute effusion in the right pleura. Operation was performed the same day under local infiltration anæsthesia, an intercostal incision being made posteriorly between the tenth and eleventh ribs. A pint of cloudy serum was evacuated from the pleura and the opening made in the diaphragm by the needle observed. This was dilated by the finger, and the subphrenic collection drained. Rubber drainage was inserted into both the pleura and the abscess cavity. The drainage furnished by this incision was not considered satisfactory but the patient's condition was bad and it was made to suffice. The man did well after the operation and now only a small sinus remains. The pleura has closed and there is resonance down to the site of incision.

Appendicitis, the etiological factor here, is probably the commonest cause of subphrenic abscess, and this is especially true in children, as Dr. Jopson had emphasized in an analysis of 23 cases of subphrenic abscess in children which he had made several years ago. The diagnosis was obscured by the absence of constitutional symptoms except fever, and the indefinite nature of the physical signs. The pleura was infected at the time of the second operation, possibly by leakage from the point of aspiration, and it was not necessary to protect it by suture or packing, and this rendered drainage of the abscess feasible by local anæsthesia. The experiments of Noetzel apparently show that the pleura is more resistant to infection than muscle or skin, but this resistance is broken in the presence of a pneumothorax. Clinically, the pleura seems to be very susceptible of infection.

Dr. William L. Rodman said Dr. Jopson was correct in saying that the majority of subphrenic abscesses are found in connection with suppurating appendicitis. Formerly it was regarded as most frequently caused by perforating gastric ulcer,

but Körte, in his masterly review of the subject, showed that the vast majority were due to suppurative lesions of the appendix. He prefers to employ the transpleural route in evacuating the abscesses, and undoubtedly that was the better method in Dr. Jopson's case.

CAVERNOUS ANGIOMA OF THE UPPER EXTREMITY.

Dr. Astley P. C. Ashhurst presented a girl, twelve years of age, whose right arm was the seat of a diffuse cavernous angioma. For his description of the case and remarks upon the condition, see paper on page 419.

Dr. Richard H. Harte said that in a worse case than that shown by Dr. Ashhurst he had used hot water injections after the method of Wyeth, but this produced no effect. He thought at first there was some improvement but the final result was no gain.

Dr. William L. Rodman has used hot water injections in four or five well-marked cases of cavernous angioma with improvement in one or two but no cure. He considers the procedure dangerous, as embolism may result, and it does not promise satisfactory effects. His preference is for excision. If one keep well out in the healthy tissue there is no more trouble than in removing a solid tumor.

FRACTURE OF THE CORACOID PROCESS OF THE SCAPULA CAUSED BY MUSCULAR ACTION.

Dr. Orlando H. Petty presented a man who had sustained a fracture of the coracoid process of the scapula from muscular action. For the description of the case and remarks upon the condition, see page 427.

Dr. Gwilym G. Davis said there is evidence to show that almost any bone in the body may be broken by direct violence, and so may the coracoid process. Dr Allis has produced this fracture by manipulation of the humerus; the break may possibly be caused by tension of the muscles inserted into the process, the coracobrachialis and short head of the biceps. The injury is probably often overlooked in dislocation of the humerus on account of the greater injury to the joint. The progress of the head of the humerus upward is stopped by the coracoid process, hence one would expect to find fractures of the process in these cases of dislocation.

Dr. Addinell Hewson was inclined to disagree with some of the statements made by Dr. Davis. The capsule of the shoulder joint is thickened at the base of the coracoid process by the coracohumeral ligament and above this is the coraco-acromial, a stout ligament connecting the coracoid and acromion processes. In forcible pushing upward of the head of the humerus, the head strikes the coracohumeral ligament and is thus prevented from striking the coracoid process. The weakest point in the capsule is below the coracohumeral ligament. With the patient holding on the car by one hand and with the other pulling on a man, action on the coracoid process would be exerted by the coracobrachialis, the short head of the biceps and the pectoralis minor. The conoid and trapezoid ligaments fix the body of the process, leaving the side and top to be acted on by the muscles. The ligaments have no effect in staying the action of the muscles. If the humerus be placed at right angles to the body and force is applied from behind, the humerus would be forced against the coracoid, and the short head of the biceps and the coracobrachialis would snap off the tip of the process.

REPORT OF THE SURGICAL CLINICS FOR STUDENTS AT THE GERMAN HOSPITAL, 1905-1906.

Dr. John B. Deaver presented this report, for which see page 431.

PERFORATION OF THE BOWEL IN TYPHOID FEVER.

Dr. Charles F. Mitchell reported eight cases of typhoid fever operated upon for perforation. He referred to the recent articles by Drs. Harte and Ashhurst on "Intestinal Perforation in Typhoid Fever" (Annals of Surgery, vol. xxxix, page 8), and the monograph by Dr. J. A. Scott, entitled "A Study of Fifty Cases of Perforation in Typhoid Fever" (*University of Pennsylvania Medical Bulletin*, May and June, 1905), which treated every phase of this subject in minute detail.

Seven of the eight cases occurred at the Pennsylvania Hospital; and he was indebted to the surgeons of that institution for the privilege of operating upon and reporting them. The other case was operated upon at the Germantown Hospital.

Three of the cases are mentioned in the article by Drs. Harte and Ashhurst and five were reported by Dr. Scott.

The history of the various cases was as follows:

CASE I.—R. P., aged 28 years; colored; hospital No. 2454; admitted October 31, 1902. Perforation, operation, and death on November 6. Had chancre within two years, used alcohol freely, and had malaria several times. Admitted to medical ward after seven days illness characterized by headache, diarrhœa, and daily chills for five days. The urine showed hyalogranular casts, and the spleen was palpable. Had moderately severe attack. On October 3, at 3 A.M., he was aroused from sleep by sudden abdominal pain (tenth day of disease) situated in both lower zones. This was the first abdominal pain complained of since his illness began. He vomited his milk; pulse became more rapid; the belly was not rigid, but generally tender. By 5.30 A.M. he vomited greenish mucus. There was moderate tympanites present, most marked in lower zones. Rigidity was now distinct, especially on the right side; slight tympanites. Doubtful movable dulness in the flanks. Breath sounds heard distinctly over abdomen as low as umbilicus. Liver dulness was absent in midclavicular line, present in axillary line. Leukocytes at 6.15 A.M., 11,360. Operation at 7.30 A.M. Perforation in ileum six inches above ileocæcal valve the size of a slate pencil. Death from general peritonitis. Autopsy.

CASE II.—A. A., aged 28 years; white; hospital number 138; admitted April 4, 1903, discharged June 25, 1903. Had malaria ten years ago, denies venereal disease. Began to feel badly three weeks ago, worked until two days before admission. Had chills, headache, cough, no epistaxis, no diarrhœa. The abdomen was soft and not tender; temperature about 103.1°. The day after admission he complained of abdominal pain; abdomen was rigid and tympanitic, but relief was obtained by the rectal tube. On April 8 he had two bloodly stools and after a week the fever began to remit, while the abdomen became painless and soft. On April 10 there was evidence of rough breathing at both bases, with fine rales, and he complained of sharp pain over the left base on deep inspiration or cough. One week later the temperature touched normal, though he still complained now and then of chest pain. On April 19 (the thirty-sixth day) the temperature rose suddenly, and he had severe pain over the costal region, where an occasional friction rub could be heard. The following morning the expression was anxious, the abdomen was very rigid but not

tender. There was no vomiting and the temperature was not altered. Diagnosed perforation, and operation done at noon. No perforation or peritonitis found and no pain was experienced after operation for four or five days. Distinct symptoms of consolidation of the left base subsequently appeared. The patient made a good recovery.

CASE III.—A. G., aged twenty-one years; hospital number 1602. Admitted August 25, 1903. Perforation, operation and recovery. Discharged November 2. Entered the medical ward on the tenth day of typhoid. The temperature was high at the start, but was soon controlled by baths. The abdomen was soft and not tender; spleen readily palpable and tender; active bronchitis. At 6.30 P.M. on August 31 (sixteenth day) he complained of sharp pain on the right side of the abdomen, which was very tender; the recti were somewhat rigid; he had neither chill or vomiting. By 9 P.M. all the symptoms had increased in severity; leukocytes were 9,600. Perforation diagnosed; operation; perforation in ilium found. This patient made a good surgical convalescence; the temperature fell and remained down for seven days after operation. On the thirty-third day the temperature again rose and the patient suffered a true relapse.

CASE IV.—F. P., aged eighteen years; admitted November 9, 1903. Perforation, operation and recovery. Admitted with a history of a mild typhoid of thirteen days' duration. At 12 noon on the fifteenth day of his disease he had sudden severe abdominal pain, tenderness on the right side, spasm of the right rectus, costal respiration, and complete obliteration of liver dulness. At 3.30 P.M. the leukocytes had arisen to 17,600; at 5 P.M. they were 16,500, and at 7 P.M. 13,400. The temperature, which was 100° at the time of the first pain, fell to 99.2 at 1.30 P.M., remained the same at 2.30 P.M. and by 3.30 P.M. had arisen to 103.3°. The operation was performed eight hours after perforation and showed free gas in the peritoneum, the presence of fluid, and a perforation in the ilium. This was a so-called typical case of perforation in which all the symptoms were present and the blood findings conclusive. This patient recovered.

CASE V.—H. C., aged twenty-eight years; admitted October 12, 1904. Typhoid perforation, operation, recovery. Discharged January 4, 1905. Entered ward on eighth day of typhoid, the onset of which was marked by fainting attacks and daily

chills until the day of admission. He had some abdominal pain, the belly was normal, the spleen palpable. On the day of admission he had a chill followed by high temperature. No malarial parasites were discovered after a careful search. The temperature range was high, though he responded readily to tubbing, but had frequent chills after being in the water. The baths were stopped on October 16 and sponges substituted, from which time he had no chills. On October 15, the eleventh day, he complained a great deal of abdominal pain. Nothing, however, developed. On October 25, the twenty-first day, he had a small hæmorrhage which did not seem to affect his general condition. He was delirious at times and very stupid. On October 30, the twenty-sixth day, at 5.30 P.M., he cried out with pain in the right side below the level of the umbilicus but radiating through the abdomen. No rigidity was present and a hot water-bag gave relief. Two hours later there was a slight rigidity of both recti, especially the right. He vomited greenish fluid. The pain continued at intervals and his condition remained the same until between 2 and 3 A.M. The leukocytes at this time were 5,900. At 3 A.M. he had another paroxysm of pain, the abdomen was slightly distended and tender, the liver dulness gone, the flanks clear. There was abdominal breathing, but the right rectus was distinctly more rigid than the left. Operation at 3.30 A.M. Cloudy fluid in abdominal cavity, perforation the size of a lead-pencil eighteen inches above the cæcum, in the centre of an ulcer the size of a five-cent piece found. The patient reacted well and continued to do well until the eighteenth day after operation when a fæcal fistula developed. This finally closed and he was discharged on January 4, 1905.

CASE VI.—G. A., aged twenty-six. Admitted August 22, 1906. Operation. Death August 30, 1906. Illness began about one week before admission, with headache, nose-bleed, anorexia and general malaise. The bowels were normal. On admission tongue was slightly coated, tip red, spleen enlarged, rose-colored spots, and iliac tenderness. Widal reaction positive; leukocytes count 8,070. Five days after admission had hæmorrhage of eight ounces, temperature falling to normal six hours after expelling hæmorrhage. The following day, at midnight, after taking his medicine, he vomited several times, broke out into a cold sweat, and complained of pain in right iliac region. The abdomen was

tender but there was no distention. Leukocyte count 9,870. On the following morning, August 29, at 8 A.M. the belly was very tender; had cough and vomited several times. Was tender over the whole abdomen but it was more marked over the right side. The temperature at this time was 102°, pulse 128 and thready in character. Operation was done at 12 noon, abdomen opened in right semilunar line and a perforation found the size of a pin-head in the ilium eight inches above the ilio-cæcal junction. This was closed with linen thread and abdominal cavity flushed out with normal salt solution. Gauze drains were used. The patient did fairly well for twelve hours but suddenly collapsed and died the following day, thirty hours after operation.

CASE VII.—F. M., aged twenty-eight years, admitted October 21, 1906. Perforation; operation. Died October 23. Unable to obtain full history, as patient did not speak English. Sent in with diagnosis of appendicitis; had not been feeling well for two weeks previous to admission but had not been confined to bed. Brought to hospital by ambulance at 11.35 A.M. with only the history of a sudden severe attack of abdominal pain the previous evening. On admission the temperature was 103°, the abdomen extremely rigid and tender all over, liver dulness present. The general appearance of the patient and the history of not feeling well for two weeks suggested the diagnosis of perforated typhoid ulcer instead of appendicitis. Operation was done within two hours after admission and pin-point perforation in ilium about four inches above ilio-cæcal valve found. Opening closed with silk sutures, peritoneal cavity not flushed with salt solution but merely drained with strips of gauze. Patient did fairly well for fifteen hours when a change for the worse set in and he died about thirty-six hours after operation.

CASE VIII.—J. C., twenty-eight years of age. Admitted November 17, 1906. Perforation, operation, death November 27. Family and previous history negative. Eight days before admission was seized with severe headache, complained also of feeling tired but did not go to bed until three days later. Had several attacks of vomiting, nose-bleed, cough; no diarrhœa. On admission temperature was 103.3°, patient seemed very dull, physical examination of chest negative, spleen enlarged but not palpable, abdomen distended but not rigid or tender. Urine examination showed the presence of a small amount of albumin and a con-

siderable number of dark and pale granular and hyaline casts. Condition remained about the same until the morning of the twenty-first when, about 11 A.M., he complained of abdominal pain; there was a little more distention, and slight rigidity of the right rectus was noted. Bladder seemed distended, catheter was passed and seventeen ounces of urine were drawn off. This seemed to relieve the pain somewhat. Leukocytes 6,450. At 2 P.M. leukocytes were 3,800, temperature 102.2°, pulse 102, breath sounds could be distinctly heard over the abdomen which was exquisitely tender, and there was considerable rigidity of the right rectus. Liver dulness was practically obliterated. At 7 P.M. temperature was 103.1°, pulse 106, respirations 42, tongue and lips dry, had not vomited but had been belching a great deal. The abdomen was greatly distended, liver dulness entirely gone, dulness in flanks, the whole abdomen was extremely tender and both sides were equally rigid. Operation. Abdomen opened in right semilunar line, immediately upon which there escaped a considerable quantity of cloudy fluid which was found to entirely fill pelvis. A perforation the size of a pin-head was found in the ilium about four inches from the cæcum. This was closed with linen thread and the whole abdominal cavity flushed with salt solution. Drains of gauze were introduced. The patient did well for five days following operation, the temperature remaining about 99, and the pulse being fairly strong. On the beginning of the sixth day after the removal of some of the drains he complained of pain in the abdomen, the temperature became elevated and he gradually grew worse, dying on the morning of the seventh day. Autopsy showed that the stitches closing the perforation had failed to hold; the presence in the pelvis of considerable pus, also a double lobar pneumonia.

Résumé.—All the cases operated upon were males; their ages ranged from eighteen to twenty-eight years; five of the eight cases being twenty-eight years old. In one case operated upon no perforation was found. This case recovered. Of the remaining seven cases, four died and three recovered, a mortality of 57.1 per cent. The first symptom of perforation appeared in three of the cases on the fifteenth day, and in the other five cases on the tenth, twelfth, twenty-first, twenty-sixth, and thirty-sixth day respectively. Hæmorrhage from the bowel preceded perforation in three of the cases, being very slight in two, while in the third it

amounted only to eight fluid ounces. One of the cases that recovered had a slight hæmorrhage.

The time between perforation and operation had been reckoned from the first onset of pain; in the cases that recovered it being 4½, 8 and 10 hours, while in the four that died it was 3, 8, 12 and 15 hours.

The leukocytes were counted in all but one case, and all showed a leukocytosis except in one of the three that recovered, which had a count immediately before operation of 5,900. In the case which had the highest count there were 17,500 leukocytes three hours after the first symptom, two hours later 16,500 and two hours still later or seven hours after perforation had taken place there was a count of 13,400. In the last case, operated on November 21, 1906, at the time of the first sign of trouble the count was 6,450, three hours later it was 3,800, and just previous to operation, or eight hours after the first symptom of perforation, there were 9,000 leukocytes.

None of the cases had more than one perforation; four were pin-head size, one the size of a lead-pencil and one that of a slate pencil. In one case the size of the perforation is not mentioned in the history.

It is interesting to note that the case which had the largest perforation was one of the three that recovered. The last eighteen inches of the ilium was the seat of the seven perforations.

The various operations were done under ether anæsthesia, incision made either through the outer border of the right rectus or through the right semilunar line. Fine silk was used to close the perforations except in two instances when linen thread was used. The abdominal cavity was flushed with salt solution in two of the cases, both of which died. Gauze drainage was used in every case and the wounds left entirely open to permit free drainage.

Dr. Richard H. Harte said that the figures presented by Dr. Mitchell were very materially below the general mortality in typhoid perforation. Through Dr. Mitchell's large experience at the Pennsylvania Hospital he has acquired ability of high order in the diagnosis of perforation. An important point of technic following operation has been emphasized by Dr. Mitchell. It is the custom of some surgeons after closing the perforation to flush the abdominal cavity with salt solution. This Dr. Harte

believes to be bad surgery as it disseminates septic material. In cases with a small perforation and in which operation is performed reasonably early, irrigation is a mistake, it being applicable only in cases in which extensive soiling of the peritoneum has taken place and where dry sponging would be out of the question. Instead, the cavity should be wiped out and packed with large quantities of gauze, this being placed between the coils of intestine. Many deaths are due to perforation in typhoid fever and the surgical side should be presented more emphatically to medical men, that more cases may be recognized early and saved. In connection with one of Dr. Mitchell's cases, Dr. Harte mentioned a personal case in which the patient died six weeks after perforation.

Dr. John B. Deaver agreed with Dr. Harte regarding irrigation in infections of the peritoneum. In these cases the best rule is to get in quickly and get out quickly, doing as little as possible. The consensus of opinion now is that irrigation is not so good as was formerly supposed. Dr. Deaver believes that perforation and hæmorrhage in typhoid have as one of the causes cold bathing. When the patient walks to the tub his resistance is taxed; later, while in the water he is chilled, and it is reasonable to believe that hæmorrhage is thus induced. It is a good thing for country patients that tubs are not available. Dr. Muhlenberg of Reading formerly used the Bland method heroically and had many cases of hæmorrhage. Now he employs a let-alone policy and sees but little hæmorrhage. If this be true, why would there not be fewer perforations if too strenuous bathing was not employed?

Dr. W. Joseph Hearn said that he does not wash out the peritoneal cavity at all in cases of peritonitis, but simply sponges. In but few cases is peritonitis general, and these patients die. The same rule applies here as in burns. If all the skin is destroyed the person dies, if only part is burned he may get well. So in cases of general peritonitis the subjects die. Dr. Hearn has recently operated on four cases of perforative appendicitis, the perforation being near the junction of the appendix with the cæcum. In all, the abdominal cavity was simply sponged out, and he is sure that three of the patients will get well and entertains hope regarding the fourth.

Dr. William L. Rodman said that Dr. Mitchell's results

were better than the average and show the value of early diagnosis and prompt operation. In the main, Dr. Rodman is in accord with what had been said about irrigation. If gross soiling of the peritoneum be present he irrigates, as in the case of gunshot wounds of the intestine. As a rule in these cases, if operation is performed before intestinal paresis and soiling of the peritoneum have occurred, irrigation is not employed. Where visible soiling is present and fæces have passed out of the intestine, irrigation is perhaps best. It is remarkable how often one finds in these cases that no soiling has occurred. Murphy in 1890 demonstrated that soiling does not take place until the intestine is handled, and this observation stands good to-day. In one case of twenty-one perforations of the intestine by a rifle ball no extravasation had occurred, though two of the perforations were large. Operation was performed an hour after the injury. In another case a great amount of extravasation was present, this including an apple core which had passed into the peritoneum. As a rule, then, there is not much extravasation if cases of perforation are operated upon promptly; if there be gross soiling of the peritoneum, irrigation is demanded.

Dr. Gwilym G. Davis has during the past year operated on eight patients with perforation and one in which the physician desired operation and no perforation was found. Six of the eight perforative cases died, though some lived quite a while after operation. Others were in extremely bad condition and lived but a short time. The non-perforative case also recovered. As to the mode of operation the transverse incision is employed and the operation begun under local anæsthesia. If perforation is found a general anæsthetic is then given. As to drainage and sponging, if the intestine is pulled out and soiling ceases, sponging is regarded as sufficient. If soiling be extensive, sponging requires too much time and causes too much shock. When fæces are spread all over the abdominal cavity, irrigation is employed. The operation requires from nine to twenty-five minutes. One must be governed by the condition of the patient. In some cases the work may be done with exactness, in others one must hurry. When perforation is not found, general anæsthesia is not necessary and the operation does not prejudice recovery. One of these patients had a second perforation some time after the first, for which an operation was done on the opposite side.

He recovered. Counting this as an additional case makes 9 cases with 3 recoveries besides the recovery from the exploratory procedure.

Dr. Mitchell, in closing, said that if he had employed local anæsthesia in one case he would not have found the perforation. When the abdomen was opened it was clear and no exudate was present; protracted search was necessary to locate the opening. In answer to a question of Dr. Rodman, Dr. Mitchell said that ten hours was the longest time between perforation and operation in the cases that ended in recovery.

Correction.—In the Transactions of the Philadelphia Academy of Surgery, meeting of November 5, published in the February issue, on page 317, line 17, for the word "found" substitute "round," so that it will read "ureteral calculi are rarely round."

BOOK REVIEWS.

TUMORS, INNOCENT AND MALIGNANT. By J. BLAND-SUTTON, F.R.C.S., Surgeon to and Member of the Cancer Investigation Committee of the Middlesex Hospital, etc. Fourth edition. Chicago: W. T. Keener & Co., 1907.

The fourth edition of this work is in many ways an improvement upon the third edition, which appeared in 1903 and was reviewed at length in the ANNALS OF SURGERY. The author has changed his classification of tumors and from the four original groups has extended the number to six, as follows: I. Tumor-Diseases of the Connective Tissues; II. Tumor-Diseases of Teeth; III. Epithelial Tumors; IV. Tumors arising from the Fœtal Membranes; V. Teratomata; VI. Cysts. In distinguishing between innocent and malignant tumors he defines them thus: "The baneful effects of innocent tumors depend entirely on the environment, but malignant tumors destroy life whatever their situation."

A most interesting chapter has been introduced concerning the cause of cancer. In this subject the author is especially well qualified to speak with authority, and he presents the three theories, the Embryonic, the Parasitic, and the Biologic theory impartially. His conclusion is that nothing is known as to the cause of cancer.

The chapter dealing with tumors of the ovary and testicle have been much improved. Two essays have been devoted to their consideration.

PAUL PILCHER.

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CORRIGENDUM.

In the March issue, page 376, after the eighth line from the top, insert the words: "other statements we have quoted."